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ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D C. 20301-3040

June 26, 1991

COMMAND, CONTROL,  
COMMUNICATIONS  
AND  
INTELLIGENCE

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS  
CHAIRMAN OF THE JOINT CHIEFS OF STAFF  
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Approval of Functional Command, Control, and  
Communications (C<sup>3</sup>) Interoperability Architecture for  
Air Operations

As requested by the Joint Staff, this office has reviewed the validated Functional C<sup>3</sup> Interoperability Architecture for Air Operations. This architecture is approved for implementation by the components of the Department of Defense and should be the basis for achieving compatibility and interoperability of Air Operations C<sup>3</sup> systems.

DoD components are expected to implement this architecture by utilizing it as authoritative guidance for preparation of Program Objective Memoranda. Specifically, all requirements for new or modified C<sup>3</sup> systems in this warfare area will be measured against this architecture for interoperability. The Joint Tactical Command, Control, and Communications Agency (JTC<sup>3</sup>A), in accordance with the provisions of DoD Directive 4630.5, will be guided by this architecture in evaluating requirements documents, investigating technology, and reviewing test documents.

Recognizing that this architecture is a dynamic document, configuration management will rest with JTC<sup>3</sup>A and the Joint Staff. It is further anticipated that the concepts, interface exchange requirements, and command and control relationships identified in this architecture will, within two years, be reflected in Joint Staff doctrinal publications.

A handwritten signature in black ink, reading "Duane P. Andrews", is positioned above the printed name.

Duane P. Andrews

CC:  
Commanders-in-Chief, Unified and Specified Commands







SUBJECT: Functional C3 Interoperability Architecture for AIR Operations,  
JTC3A Report 8034

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## CHAPTER 1

### INTRODUCTION

#### 1-1 BACKGROUND

This report provides a tactical command, control, and communications (C3) functional interoperability architecture (FIA) for joint air operations. It is one of a series of FIAs published by the Joint Tactical C3 Agency (JTC3A). These architectures constitute important elements of the Joint Tactical C3 Architecture, which serves as a basic mechanism for achieving compatibility and interoperability of U.S. tactical C2 systems and communications equipment, as required by DOD policy. The FIAs for maritime and amphibious operations, intelligence, and joint task force control are being developed. The FIAs for special operations, air defense and airspace control, combat service support, fire support operations and land combat operations have been validated by the Joint Staff and approved by Assistant Secretary of Defense (ASD) (Command, Control, Communications, and Intelligence) (C3I).

DOD policy, contained in DOD Directive 4630.5, is "to develop, acquire and deploy tactical command, control, communications and intelligence (C3I) systems and equipment that effectively meet the essential operational needs of U.S. tactical forces. They must be compatible and interoperable, where required, with other U.S. tactical C3I systems and equipment, and with nontactical C3I systems and equipment."

The responsibility for developing and maintaining the Joint Tactical C3 Architecture is assigned by DOD Directive 5105.19 to the Director, JTC3A, "...who shall: develop and maintain a joint tactical C3 architecture by defining the architecture for joint tactical communications systems (including nonstrategic nuclear forces C3) and by defining interface specifications required to ensure interoperability and information flow among C2 systems in accordance with the guidance and direction provided by the CJCS."

The Joint Chiefs of Staff provide the following additional direction in JCS MOP 160 regarding the architecture: "The Joint tactical C3 Architecture will be developed by JTC3A, in coordination with the CINCs, Services, and Defense agencies. This architecture will not necessarily be a single document, but may consist of a hierarchy of unified and specified command, service, and agency architectures already in use. As portions of the architecture are completed, they will be validated by the Joint Chiefs of Staff, approved by the Secretary of Defense, and implemented by the DOD components."

#### 1-2 OBJECTIVE

The objective of this report is to establish a tactical C3 functional interoperability architecture for joint air operations in a conventional war. The architecture addresses the connectivity requirements during joint operations for the



The architecture identifies joint C3 interface requirements for a generic joint task force that includes five components: U.S. Army, U.S. Air Force, U.S. Navy, U.S. Marine Corps, and a Joint Special Operations Task Force. As explained below, joint interface requirements for special operations are identified in a separate architecture. Interface requirements for special operations are discussed in this report only as they pertain to tactical functions included in this architecture.

Several supporting tasks and missions associated with air operations are addressed in other JTC3A functional architectures published separately. For example, connectivities for the airspace control/air defense functions necessary to integrate the Antiair Warfare Commander (AAWC), Control and Reporting Center (CRC), and Tactical Air Operations Center (TAOC) during offensive counterair operations are addressed in the Airspace Control /Air Defense FIA. These tasks are referenced in this report when necessary for clarity, but the joint interface requirements for these functions are not duplicated. The joint interface requirements for these related functions and the reports in which they are identified are listed below:

1. Air defense and airspace control - JTC3A Report 8006, May 1988.
2. Close air support - JTC3A Report 8016, the fire support FIA, November 1989.
3. Special operations - JTC3A Report 8015 March 1990.
4. Air operations in a maritime environment - the maritime and amphibious operations C3 architecture - JTC3A Report 8121, January 1990.
5. Intelligence support - the C3 interoperability architecture for intelligence, JTC3A Report 8030, March 1990.

#### **1-4 ORGANIZATION OF THE DOCUMENT**

The architecture contains the following:

- a. Discussions of the internal C3 functions for air operations conducted by the joint force headquarters and each component of the joint force.
- b. An analysis of the tactical functions that make up the air operations architecture, and a determination of joint tactical C3 interface requirements involved in the execution of these functions.
- c. A series of figures, matrices, and tables that depict the interface requirements for each C2 element, the categories of information involved, and the means by which the information is exchanged.
- d. Discussions concerning the interoperability findings of the report. This analysis identifies existing or potential impediments to joint interoperability

identified during research for the report, and provides recommendations to reduce or eliminate these deficiencies.

Chapter 2 discusses the organization and C2 functions of each component force during air operations. These discussions are intended as an overview of service connectivities and an explanation of service C2 functions that are related to the joint interfaces identified in the architecture. As explained above, these discussions and other information in the report are a condensation of the more detailed information in the supporting analysis.

Chapter 3 is an analysis of joint C2 functions within each of the nine tactical functions addressed in this architecture. The C2 functions at the joint force headquarters also are discussed with an emphasis on the air resources allocation process for a joint force. The joint interface requirements for each of the nine functions are provided in matrix format.

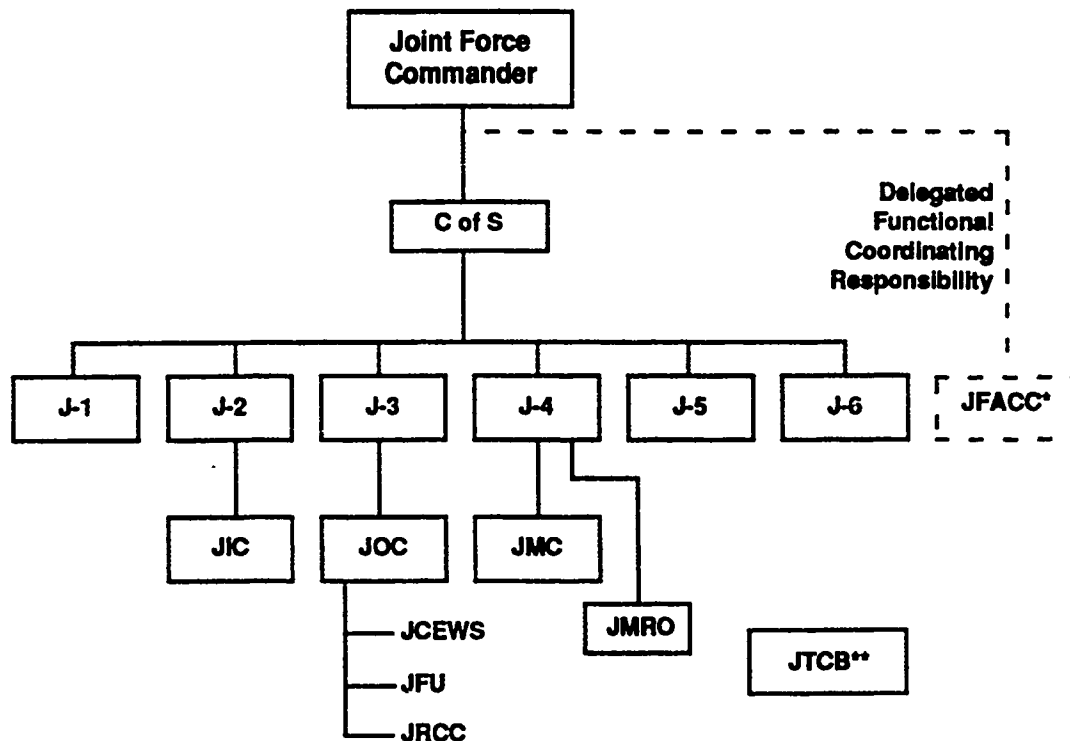
Chapter 4 portrays the C3 functional interoperability architecture for air operations. The C2 elements and connectivity requirements are presented in a series of matrices, tables, and organizational connectivity diagrams.

Chapter 5 contains the interoperability findings of the report. In general, the findings comprise the deficiencies and issues that research and analyses identified as impediments to interoperability. Recommendations to reduce or eliminate the deficiencies are provided.

Appendix A is a glossary of terms.



2. Joint Operations Center (JOC). The JOC serves as the focal point for all operational and intelligence matters pertaining to the joint force. Tasks performed include planning, direction, execution supervision, situation monitoring, reporting, and evaluation of the operations of the forces and resources assigned.



\* JFACC is a coordinating responsibility that may be delegated by the joint force commander to an air capable component.

\*\* A staff agency chaired by the J-3 with representation from J-2, other staff agencies, and the components, as appropriate.

Figure 2-2. Representative Headquarters Staff Elements for Air Operations

3. Joint Rescue Coordination Center (JRCC). When established, the JRCC may be at the joint force headquarters or headquarters of the component commander designated as the Search and Rescue (SAR) Coordinator. At the joint headquarters, the JRCC usually falls under staff supervision of the J-3.



with the JFACC will coincide with those of the Air Force component commander. Parallel connectivity requirements would be valid regardless of which air capable component commander is designated as the JFACC. Therefore, for clarity and simplicity of presentation, connectivities depicted in the matrices do not specify the JFACC as a separate C2 element. The analyses in support of this report considered the C3 implications for each of the alternatives available to the JFC regarding designation of the JFACC. No interoperability deficiencies are inherent in any alternative that precludes operating as JFACC.

**C. C3 Support for Joint Force Headquarters.** When approved by the Chairman, Joint Chiefs of Staff (CJCS), the Joint Communications Support Element (JCSE) supports the joint headquarters and Joint Special Operations Task Force (JSOTF). JCSE support includes installation, operation, and maintenance of C-E facilities and systems of these two headquarters and, when required, satellite terminals at service components and supported or supporting CINC or allied headquarters. USCINCCENT has been assigned responsibility for operation, maintenance, manning, readiness, and periodic testing of the JCSE. This architecture considers that the JCSE has been assigned to support the joint force headquarters.

A discussion of other joint force headquarters functions including the air apportionment process and helicopter support of the joint force headquarters is provided in chapter 3 as an element of the analyses of joint C3 functions.

## **2-2 U.S. ARMY AVIATION C3 FUNCTIONS AND ORGANIZATION**

**A. Introduction.** Army aviation forces are designed to operate as an integral element of the combined arms team. Combining speed, mobility, firepower, and lift capabilities, these forces perform an array of missions across the range of combat, combat support, and combat service support. U.S. Army aviation plays a key role in the Army's AirLand Battle Doctrine, which addresses the simultaneous conduct of the close, deep, and rear battles. U.S. Army aviation elements participate in joint operations when such operations are conducted, and when called upon and available through direct support provided to other services.

**B. U.S. Army Aviation Missions.** Army aviation combat operations include attack, reconnaissance and security, air assault, air combat, special operations, and command and control missions. The main purpose of attack operations is to defeat enemy armored, mechanized, and helicopter forces during offensive and defensive operations. Reconnaissance operations provide intelligence and assess damage from friendly and enemy fires. Aviation security operations detect enemy forces and help prevent unexpected attack. Air assault operations use helicopter assets to maneuver on the battlefield to engage and destroy enemy forces. Air combat operations protect combined army maneuver forces, augment air defense forces, and provide aviation self defense. U.S. Army aviation supports special operations in a joint environment by furnishing dedicated aircraft and accomplishes the C2 mission by providing specially configured aircraft for commanders and their staffs.

Combat support (CS) operations by U.S. Army aviation assets provide operational assistance to combat elements. This report notes that these operations differ from air assault missions that are combined arms maneuver operations. These forces also may participate in mine and countermine operations and search and rescue.

Combat service support (CSS) operations provide assistance to sustain combat forces in air movement and aeromedical evacuation. Air movement operations using aviation utility and cargo assets for other than air assault operations and CS air movements are combat service support operations. CSS air movements are performed to support close and rear operations. CSS missions into the deep area are considered to be air assault combat missions. Army medical forces employ air ambulances to support medical evacuation throughout the close and rear areas and possibly during deep operations.

**C. U.S. Army Aviation Organizational Structure.** Aviation brigades are organic to divisions, corps, and selectively, echelons above corps (EAC). Figure 2-3 portrays a typical U.S. Army aviation organizational structure at EAC, heavy corps, and heavy division levels.

The aviation organizational structure at EAC includes a theater army aviation battalion (THTR AVN BN), a CH-47 medium lift battalion (MDM BN), and possibly an Air Traffic Services (ATS) unit.

Aviation assets are provided in a number of units in the heavy corps. The typical aviation brigade includes an aviation group and two attack helicopter regiments. The aviation group includes an ATS battalion, two UH-60 assault helicopter (ASLT) battalions, a CH-47 battalion, and a command aviation battalion (CMD BN) with companies that provide aircraft for field artillery aerial observers in corps artillery and for corps command, control, and communications. The corps armored cavalry regiment (ACR) includes an organic aviation squadron (AVN SQDN) equipped with utility, scout, and attack helicopters. Aerial exploration (AE) battalion of the corps military intelligence (MI) brigade includes aerial surveillance (AS) and electronic warfare (EW) companies. The AS company provides the corps with an airborne platform for imagery collection (OV-1D, MOHAWK). The EW company provides an airborne electronic intelligence (ELINT) capability (RV-1D QUICK LOOK) and the airborne segment (RV-21) of the Guardrail communications intelligence (COMINT) system. All of the aerial assets of this battalion are fixed wing. Medical evacuation battalion of the medical (MED) brigade includes a number of air ambulance companies in direct support of divisions and in general support of the corps.







the principal means of achieving this objective. One of the objectives of the ATCCS is to integrate aviation operations into the five battlefield functional areas (BFAs): maneuver, intelligence or electronic warfare, fire support, air defense, and combat service support. In support of this objective, designated supporting elements within the ATCCS are established to support specified C2 functions for aviation operations. The Army Battlefield Interface Concept (ABIC) documents the interface requirements within the ATCCS. The Army Airspace Command and Control (A2C2) system is designed to coordinate concurrent use of airspace to maximize employment of combat power within a designated sector of airspace over the battlefield. When fully operational, the Maneuver Control System (MCS) will enhance the exchange and processing of data significantly among Army C2 elements, including those involved in aviation operations. The BCE and ASOC support the integration of U.S. Army and U.S. Air Force C2 systems during joint air operations involving these forces. When the U.S. Army conducts operations as a component of a joint force, C3 functions involving aviation operations are coordinated with the Airspace Control Authority (ACA) and the Joint Force Air Component Commander (JFACC) to ensure coordination of U.S. Army aviation operations with components of the joint force.

2. Communications. The primary means of communications supporting C2 functions for Army aviation operations is single-channel radio. Other means employed to meet specified requirements include multichannel, satellite, and wire connectivities. The aviation brigade establishes and controls internal and external radio and telephone nets to meet its own C3 requirements and those of its subordinate units. Key internal radio nets include VHF-FM for operations, intelligence, and logistical requirements. Other internal nets use UHF and HF nets to support aviation operations and radio teletypewriter requirements. Key external radio nets support VHF-FM interfaces with the DTOC for operations and intelligence functions and HF connectivities with the DTOC for radio teletypewriter requirements. The Corps aviation brigade establishes the same internal and external nets as the division aviation brigade.

The primary means for requesting, coordinating, and employing support of the assault and attack helicopter battalion is secure FM radio. U.S. Army aircraft are equipped with VHF-FM, VHF-AM, and UHF-AM radios. Some Army aircraft equipped for special missions employ HF radios.

The U.S. Army is improving its information exchange capability on the battlefield with the introduction of several advanced communications systems. Mobile Subscriber Equipment (MSE) is being introduced incrementally, with full fielding expected by 1994. With the fielding of MSE, radioteletype systems are replaced by facsimile. This system will integrate wire and radio systems, automatically locate subscribers, and enhance information exchange across the battlefield. This system will facilitate planning and coordination of aviation operations, particularly at the corps and division level. The Single Channel Ground and Airborne Radio System (SINCGARS) is a new series of VHF-FM radios that are replacing the current AN/VRC-12 family of radios. SINCGARS provides more channels, increased equipment reliability, expanded data exchange capability, and increased resistance to electronic countermeasures. These radios will enhance



airspace, and neutralizing or destroying his forces and the infrastructure supporting his air operations.

b. Suppression of Enemy Air Defenses (SEAD). These operations are conducted to neutralize, destroy, or degrade enemy air defensive systems in a specific area by physical or electronic attack. The goal of SEAD is to permit friendly forces to perform missions effectively without interference from enemy air defenses.

2. Air Interdiction (AI). These missions are conducted to delay, disrupt, divert, or destroy an enemy's military potential before it can be brought to bear effectively against friendly forces. Typical targets include enemy surface forces, communications networks, C2 systems, and combat supplies. A subset of AI is battlefield air interdiction (BAI), which is directed against land force targets having a near-term effect on the scheme of maneuver of friendly forces. BAI requires joint coordination at the component level during planning; but once planned, BAI is controlled and executed as an integral part of a total AI campaign. Both tactical and strategic aircraft may be employed in air interdiction.

3. Airlift Operations. These missions are used to deploy, employ, and sustain military forces. Theater airlift is performed within a theater of operations and supports theater objectives through the rapid and responsive movement of personnel and supplies. Theater airlift comprises four basic tasks: logistical airlift, airborne operations, intratheater aeromedical evacuation, and special air support operations.

4. Reconnaissance and Surveillance. The objective of these missions is collecting information from airborne, orbital, and surface based sensors. Tactical and strategic aircraft perform these operations.

5. Electronic Combat (EC). These missions are categorized by the Air Force as a specialized task. The objective of EC is to protect friendly electromagnetic capabilities and actions while neutralizing or destroying the enemy's electromagnetic capabilities. This report focuses on electronic countermeasures (ECM) and electronic support measures. Not addressed are electronic counter countermeasures (ECCM) or self-protection systems.

6. Combat Rescue (CR). Another specialized task identified by the Air Force is combat rescue of downed combat aircrew personnel. These operations are conducted in both permissive and hostile environments. The task is assigned to the Military Airlift Command (MAC). U.S. Navy and U.S. Marine Corps use the term Combat Search and Rescue (CSAR) to describe this task.



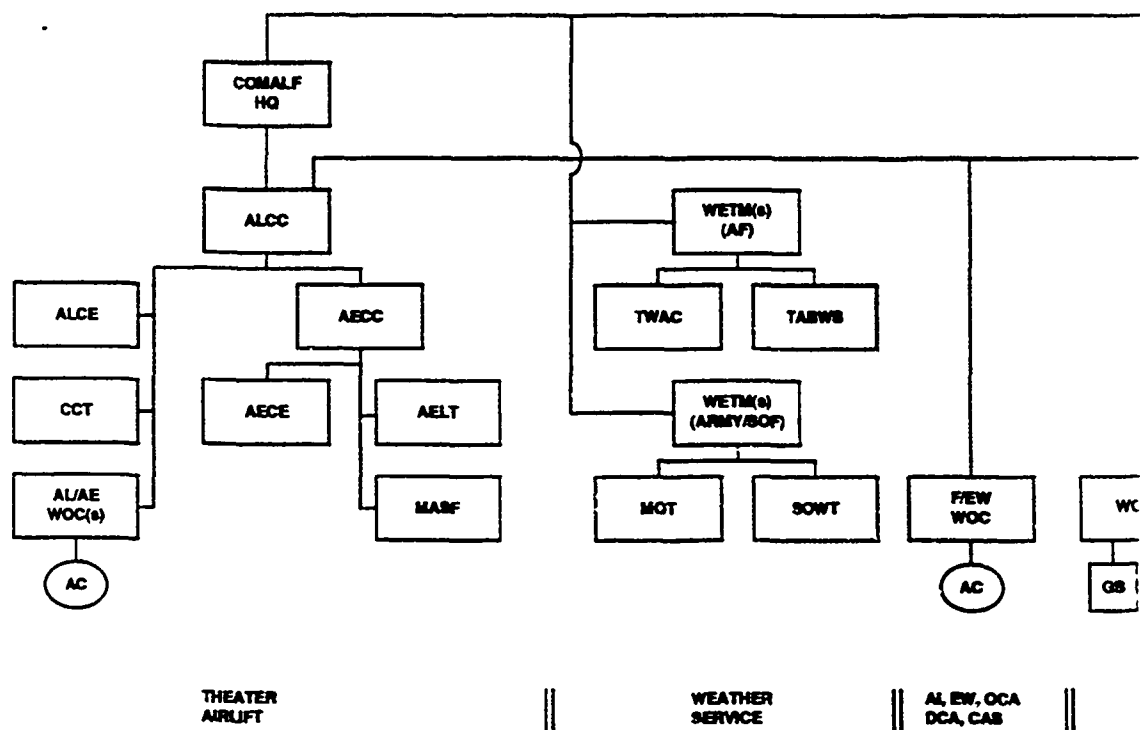
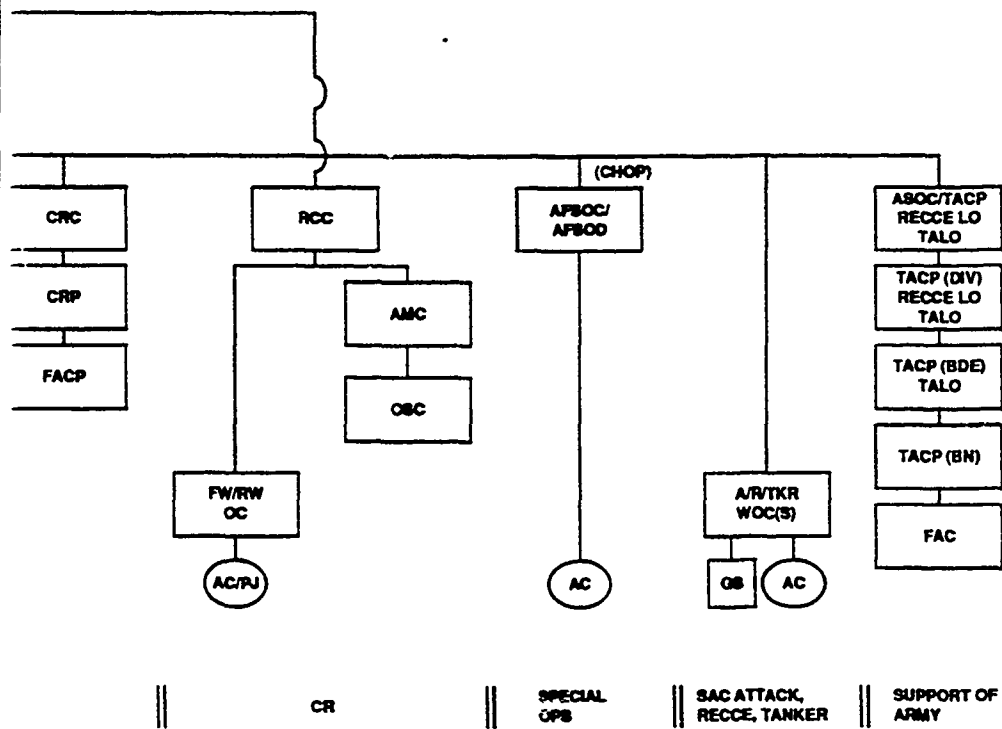


Figure 2-4



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the functional areas. C2IPS is primarily a deployable C2 automation system that also supports fixed location. C2IPS will use USTS, HF, digital data network (DDN), and various other communications to provide for the connectivity it requires.

5. Systems Supporting Combat Rescue Missions. Current C2 systems for use under tactical wartime conditions assist CR forces to locate and navigate to the object of combat rescue. Automatic direction finder (ADF) equipment is used by several types of aircraft in CR operations for locating sources of UHF and FM signals generated by the survivor's radio. In addition, various aircraft are equipped with features such as GPS terminals, terrain-following and terrain-avoidance radars, a FLIR system, INS, a map display, a radar beacon finder, and computer generated search patterns.

6. Systems Supporting Weather Support. The primary C2 systems in weather services that impact on tactical operations are the Automatic Weather Network (AWN), the Advanced Weather Analysis and Prediction System (AWAPS), and the Tactical Imagery Display Satellite (TIDS) system. The AWN is a meteorological data collection and dissemination system interconnecting overseas digital weather switches and the Air Force Global Weather Central. The primary mission of the AWN is to transmit weather intercept data rapidly from the point of intercept to the Central to support high priority missions.

The AWAPS is a computer system that performs global weather analysis. It takes weather observation data collected worldwide and develops a numerical model that forecasts weather at the surface and various pressure levels. The TIDS system allows weather imagery data to be received at the Joint Forecast Unit at the joint force headquarters as well as the WETMs. The imagery data is transmitted by satellite and received by receive-only terminals at tactical locations.

## 2-4 U.S. MARINE CORPS AVIATION C3 FUNCTIONS AND ORGANIZATION

A. Introduction. U.S. Marine Corps forces are organized for combat as Marine Air Ground Task Forces (MAGTFs). A MAGTF is an integrated, balanced air-ground combined arms force, organized for combat under a single commander. Regardless of size, a MAGTF always consists of four basic components: a Command Element (CE), a Ground Combat Element (GCE), an Aviation Combat Element (ACE), and a Combat Service Support Element (CSSE). The Marine Expeditionary Force (MEF), used for the interoperability analyses in this architecture, is composed of a Command Element, division, aircraft wing, and a force service support group. It is capable of conducting a wide range of amphibious assault and other operations, with 60 days of support for sustained operations ashore. The Marine Expeditionary Brigade (MEB) used in this architecture is composed of a command element, a reinforced infantry regiment, an aircraft group, and a brigade service support group. A Marine Expeditionary Unit (MEU), the smallest MAGTF, usually consists of a reinforced infantry battalion, a composite aircraft squadron, and a MEU service support group. A MEU is capable of special operations.







generating airlift and aeromedical evacuation requirements or requests. The CSSE also provides the helicopter support teams (HSTs) to improve the functioning of helicopter assault support operations.

5. Aviation Combat Element (ACE). The aviation combat element (ACE) is task organized to perform normal aviation support functions as required by the tactical situation and MAGTF size and mission. ACE structure consists of a squadron, group, or wing headquarters, flying squadrons and detachments, and supporting squadrons/units for air control, combat support, and combat service support. The Tactical Air Commander commands the tactical functioning of the ACE through the Marine Air Command and Control System (MACCS). The MACCS is organized to exercise control of operations involving the following functions: airspace and air traffic control; employment of aviation assets and weapon systems; and selection, coordination, and integration of MACCS agencies for all U.S. Marine Corps aviation tactical functions. The activities of the MACCS fall into the major categories of air direction and air control. Air direction consists of guidance and supervision that a commander employs to focus resources on mission accomplishment. Authority to exercise air direction is delegated from the MAGTF commander, who has overall responsibility for mission accomplishment, through the ACE commander, and subsequently, in varying degrees to subordinate commanders, staffs, and agencies. Figure 2-5 depicts the C2 elements of the MACCS. The following paragraphs briefly discuss these elements.

a. Tactical Air Command Center (TACC). The TACC is the senior agency of the MACCS from which the MAGTF Tactical Air Commander directs, controls, coordinates, and supervises all MAGTF tactical air operations. The TACC is also the principal operational facility for coordination of tactical air operations with other services, allies, and external agencies.

b. Tactical Air Operations Center (TAOC). The TAOC employs surveillance radar to detect, identify, and control the intercept of hostile aircraft and missiles; provides airspace management and navigation assistance to friendly aircraft and provides target assignment for weapon systems. In addition to the control of air-to-air operations, the TAOC also directs the operations of subordinate surface-to-air missile agencies. The TAOC functions as the alternate TACC when directed.

c. Direct Air Support Center (DASC). The DASC is the principal air control agency responsible for direction of air operations directly supporting ground forces. This agency is collocated with the Fire Support Coordination Center (FSCC) of the GCE. The DASC provides the means to process immediate air support requests, coordinates aircraft employment with other supporting arms, manages terminal control assets with supporting ground combat forces, and controls assigned and itinerant aircraft transiting the DASC's area of responsibility.

d. Marine Air Traffic Control Squadron (MATCS) Detachments. The MATCS detachments are provided by the MACCS. The MATCS detachments provide continuous all-weather Air Traffic Control (ATC) service at expeditionary

airfields in support of MAGTF. They can provide limited ATC service at remote landing sites.

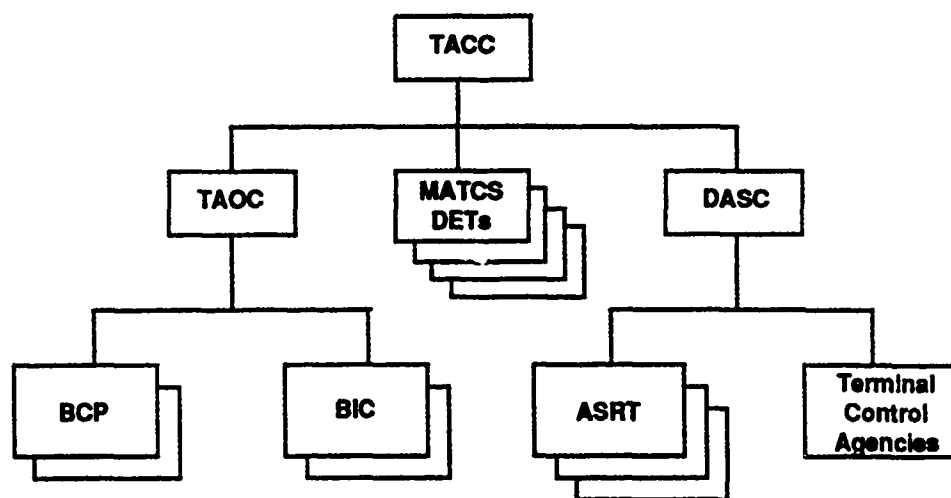


Figure 2-5. U.S. Marine Corps Air Command and Control Agencies

e. Air Support Radar Team (ASRT). The ASRT is a terminal air control agency subordinate to the DASC. It provides, operates, and maintains the facilities for precision terminal control of aircraft in day/night and all-weather conditions in support of MAGTF operations. This control agency supports deep air support interdiction missions, close air support missions, and may support assault support missions. In these situations, the ASRT may provide assistance to aircraft performing an instrument descent until it reaches visual flight conditions.

f. Organic MACCS terminal agencies include the Tactical Air Coordinator (Airborne) (TAC(A)), the Helicopter Coordinator (Airborne) (HC(A)), the Forward Air Controller (Airborne) (FAC(A)), and the Naval Aviation Observers (NAO).

g. Tactical Air Control Party (TACP). The TACP is not an organic element of the MACCS. However, it is particularly important to air operations because it advises the commander about air operations employment and provides communications connectivity with applicable elements of the MACCS.

h. Forward Air Controller (FAC). The FAC is not an organic element of the MACCS, but performs directly related functions during air operations. The FAC is a specially trained aviator or pilot and member of the TACP who controls not only close air support aircraft, but also helicopters and KC-130, when







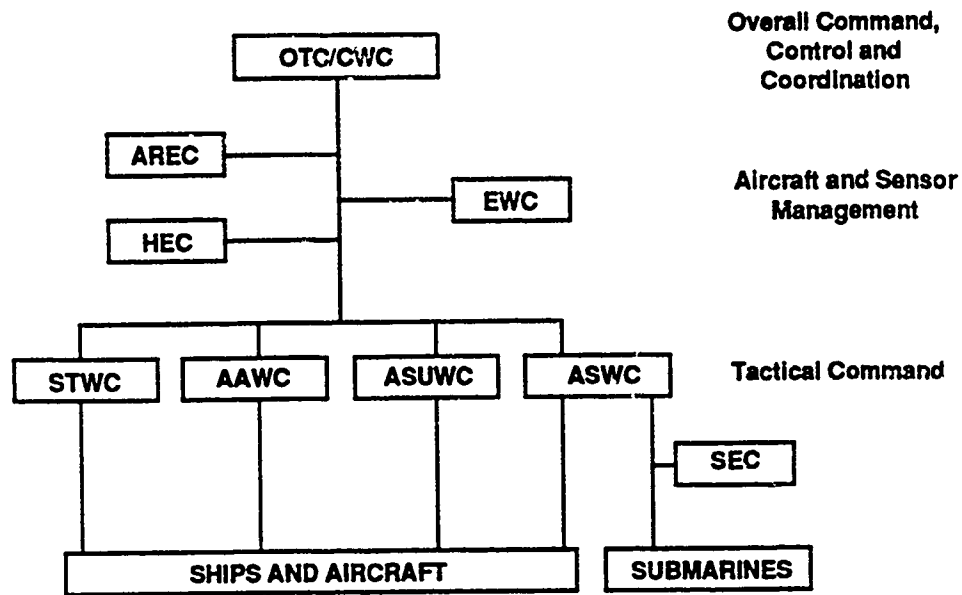


Figure 2-6. Standard OTC/CWC Organization

1. U.S. Navy Combat Search and Rescue Operations (CSAR). U.S. Navy CSAR is organized under the OTC or CWC depending on force composition and operating conditions. The C2 element responsible for supervision of the force CSAR operation is the Rescue Coordination Team (RCT). The senior element during the terminal phase of the operation is the on scene commander (OSC), who is responsible for control and coordination of elements operating in the recovery area. Recovery helicopters assigned to a CSAR mission are flown to and from the recovery area under control of the Airborne Mission Commander, who is responsible for managing CSAR radio nets, coordinating flow of aircraft to and from the recovery area, and refueling of mission aircraft. Fighter or attack aircraft employed to suppress the enemy in the recovery area remain under control of the AAWC or STWC until arrival in the recovery area, where the OSC exercises local control.

2. Aeromedical Airlift Operations. Aeromedical evacuation of injured or disabled U.S. Navy personnel from the injury site or from a staging area is accomplished routinely by specially configured helicopters. First level surgery is performed on LCC and LHA ships and may be available on CV/CVN class ships. When required, the patient is transferred by helicopter to Medical Treatment Elements (MTE) and Medical Treatment Facilities (MTF). The MTE/MTF is a medical installation ranging in size from a battalion aid station to a casualty receiving and treatment ship or fleet hospital. If additional medical care is required, patients are flown by helicopter to aeromedical Air Force staging areas, or facilities (ASA/ASF) tasked with





units. U.S. Air Force SOF may be organized into an Air Force Special Operations Command (AFSOC) for theater operations, or tailored into Air Force Special Operations Detachments (AFSODs) or elements (AFSOEs). U.S. Navy organizations for special operations are active and reserve component Sea-Air-Land (SEAL) Teams, Special Boats Units, and SEAL Delivery Vehicle Teams. U.S. Navy SOF typically deploy as Naval Special Warfare Task Groups (NSWTGs) and Navy Special Warfare Task Units (NSWTUs). Marine Expeditionary Units (MEUs) are capable of conducting special operations.

Special operations missions are joint in nature; therefore, when SOFs from the services are assigned to the joint commander, operational control of these SOFs is exercised through a subordinate Joint Special Operations Task Force (JSOTF) commander. However, instances may arise when a service component commander may have operational control of the SOF elements assigned from his own service.

As explained in the introduction to this report, the overall C3 requirement for special operations is covered in a separate architecture. Special operations are discussed in this architecture only to the extent that they impact upon the specific air operations addressed here. In particular, the report discusses SOF involvement in combat search and rescue operations.



### 3-2 THE AIR RESOURCES ALLOCATION PROCESS

**A. General.** Upon receiving apportionment decisions and air support request messages and reviewing threat situations, each air-capable component prepares an air allocation request for transmission to the JFC. The allocation request describes how the air-capable component intends to allocate air sorties to meet the joint force commander's apportionment decision. It presents the number of sorties to be flown during the air tasking day by mission and type aircraft. The allocation request also serves as a vehicle for reporting excess sorties not needed by the air-capable component and available for support to the joint force as a whole and for requesting additional air support beyond the component's own capability.

**B. Sortie Allotment.** The JFACC reviews each allocation and prepares a sortie allotment message to be sent to the components for the applicable air tasking day. The JFACC reviews each allocation request and proposes the allotment of sorties for the applicable air tasking day to the JFC for approval. The sortie allotment message is used to provide a means by which the JFC approves the air employment/allocation plans of his subordinate commanders and fills his subordinate commander's request to the extent possible from those sorties declared in excess in the subordinate commander's air allocation/request message. This message covers the following four areas:

1. Revisions to a component's planned allocation. These revisions are based on approval or disapproval of component requests based on availability of sorties from other components to fill approved requests.
2. Approval or disapproval of component requests and allotment of excess sorties from other components to fill approved requests.
3. Allotment of component excess sorties to fill mission requirements for the benefit of the force as a whole.
4. Revisions to mission data with respect to time or mission priority.

**C. Tasking Confirmation.** After receiving the sortie allotment message, the components complete their tasking process and confirm to the supported component(s) that the requested support will be provided. This information is conveyed in either an air tasking/confirmation (ATOCONF) message or a request confirmation (REQCONF) message. Joint Pub 6-40 provides message format guidance.

**D. Procedures to Enhance Responsiveness to Tactical Requirements.** Two common techniques for providing responsive air support to meet the demands of a tactical situation are the use of immediate requests for air support and mission-type orders. Immediate requests may be filled from previously approved on-call or alert sorties to meet unforeseen, emergency situations. If no on-call sorties are available to satisfy immediate air requests or other emergency requirements, the JFACC may revise the missions assigned by the ATO to satisfy these requirements. Such requests are forwarded to the JFACC. The request may be filled with sorties scheduled for another component. Mission-type orders specify general target types, geographic

areas, and attack windows and are used when the targets may not be known. This technique is particularly useful against mobile targets, such as those in battlefield air interdiction whose location cannot be specified with sufficient certainty for the lead times required in the air tasking process, yet the anticipated target categories permit selection of appropriate munitions. The mission-type order assures inclusion of the approved sorties in the allocation and air tasking process and permits early flight planning and coordination without early commitment to specific targets. These still would be schedule, on-call, or immediate requests. An ATOCONF message directs execution and provides specific mission data and target detail.

**E. Helicopter Support in Joint Air Operations.** If a tactical situation requires cross-service tasking of U.S. Army and U.S. Marine Corps helicopters, service doctrine governs the employment. Since these helicopter assets are not controlled as part of the previously discussed air tasking process, a separate procedure is used to obtain the needed helicopter support. The simplest procedure is direct coordination between the components. Request for helicopter support usually would be made to the supporting component via the JFC. If the assets needed exceed those that can be arranged directly, the requesting component forwards a free-text voice or record message request to the JOC. The JOC then tasks the supporting component either by an operations or fragmentary order with authority for direct liaison. Upon receipt of the tasking, the supporting component transmits a request confirmation message to the component requesting the support.

### 3-3 OFFENSIVE COUNTERAIR OPERATIONS

**A. General.** Air superiority permits use of the enemy's airspace to perform necessary missions, but denies the enemy the use of friendly airspace. It is achieved through offensive and defensive missions, having the ultimate goal of air supremacy. Air superiority permits nonprohibitive interference with air, land, or maritime operations.

Joint Pub 3-01.2, Joint Doctrine for Theater Counterair Operations, defines counterair operations by first defining air operations. Air operations are conducted to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy forces. Counterair operations include such measures as use of interceptors, bombers, antiaircraft guns, surface-to-air missiles, and electronic countermeasures to destroy the air or missile threat before and after it is launched. Other measures taken to minimize the effects to hostile air actions are cover, concealment, dispersion, deception (including electronic), and mobility. Both offensive and defensive actions are involved. The former range throughout enemy territory and generally are conducted at the initiative of friendly forces. The latter are conducted near or over friendly forces and are reactive to the initiative of the enemy air forces.

As explained in the introduction, a separate functional interoperability architecture addresses C2 for joint air defense operations. The interfaces established in this architecture are focused on offensive counterair operations.

**B. Suppression of Enemy Air Defenses (SEAD).** SEAD is a counterair task and a close adjunct of offensive counterair operations. SEAD operations are conducted to neutralize, degrade, or destroy enemy air defenses and systems in specific areas by physical attack or electronic warfare. Effective SEAD permits the primary objectives of other missions to be accomplished. SEAD requires joint coordination to employ surface and airborne weapons systems in systematic campaigns or localized operations.

**C. Armed Helicopters in Offensive Counterair Operations.** Joint Pub 3-01.2 indicates that armed helicopters are to be included in counterair planning. The employment of attack helicopters in air combat and for attack of ground targets requires coordination with other air operations including those conducted by other components of a joint force. This architecture considers the joint C3 connectivities required to conduct these C3 functions.

**D. C3 in Joint Offensive Counterair Operations.** Overall direction of counterair operations is the responsibility of the joint force commander. A fundamental tool for controlling employment of air assets is the apportionment decision exercised by the joint force commander. The air-capable components react to apportionment guidance by allocating sorties according to aircraft type and mission.

The JOC interfaces with the senior operations centers at each service component. The JIC will exchange intelligence information with the principal intelligence centers of the air-capable components, and with EACIC to support potential efforts for joint suppression of enemy air defenses. Similar considerations for coordination of operations and intelligence influence the joint connectivity requirements among service components.

**E. Joint Interface Requirements for Offensive Counterair Operations.** The joint C3 connectivity requirements for offensive counterair operations are shown in figure 3-2.

### **3-4 AIR INTERDICTION (AI)**

**A. General.** Air interdiction attacks are part of a systematic and persistent operation designed to limit the enemy's movement and reinforcement activities. These missions destroy, neutralize, or delay enemy potential before it can be brought to bear effectively against friendly forces. Air interdiction missions are flown at such distances from friendly forces that detailed integration with supported ground forces is not required. A subset of AI is battlefield air interdiction (BAI)/deep air support (DAS) directed against land force targets having a near-term effect on the scheme of maneuver of friendly forces. The primary difference between BAI and the remainder of the AI effort is the level of interest and emphasis the land commander places on the process of identifying, selecting, and attacking certain targets. Overall guidance on conducting joint operations is contained in Joint Pub 3-03, Doctrine for Joint Interdiction Operations.

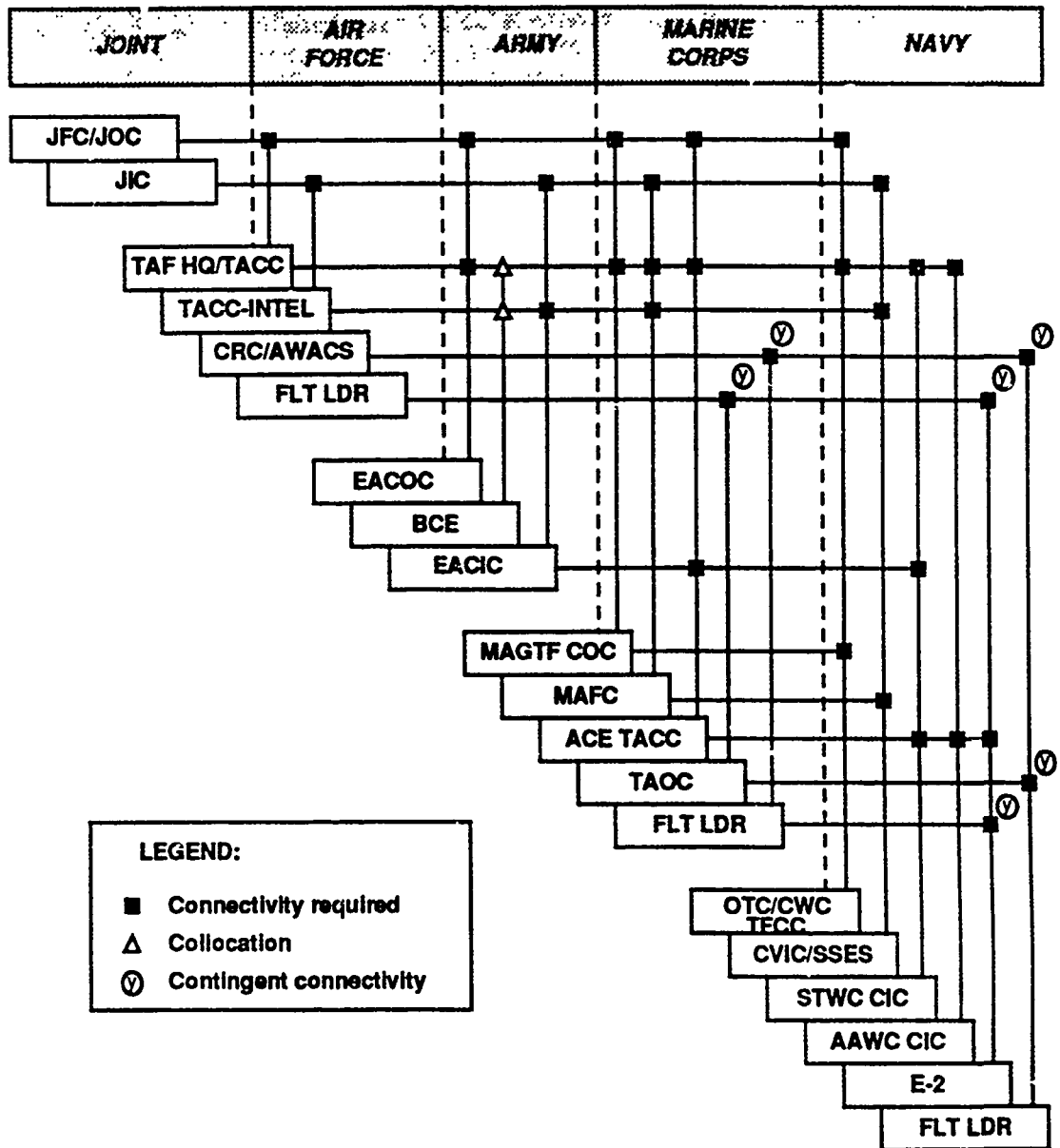


Figure 3-2. Joint C3 Connectivity Requirements for Offensive Counterair Operations

Integration of these efforts into a single, cohesive operation may be achieved through a variety of means, including establishing zones or areas of attack for each service to concentrate its interdiction efforts, deconflicting missions by times of arrival, or through integration of the service missions into composite strike forces. Regardless of the means selected, extensive planning and coordination are required prior to and during execution. Additionally, provisions must be made for safe passage of the interdicting force over friendly areas when en route to or from the target area. En route contact with the airspace control elements can provide radar following or control, and allows the commander to divert or recall the force as well as the means to provide updated information concerning weather, target, or enemy defenses.

**B. The Air Interdiction Tasking Process.** The air interdiction effort stems from the joint force commander's overall plan of operations that establishes the interdiction area, the effects desired, and the priority of tasks to be accomplished. The process of apportionment determines the level of effort for interdiction as a percentage or a priority. Interdiction planning is coordinated at the Joint Targeting Coordination Board (JTCB) to assure that the joint objectives are being satisfied. All components provide an input into the planning process.

Air interdiction planning for supported ground forces begins at the tactical level. At the operational level of U.S. Army EAC and U.S. Marine Corps MEF, the planning will focus on air interdiction targeting, combined arms deep strikes, and special force operations that will delay or disrupt enemy movement. In this architecture, deep air support operations conducted by the U.S. Navy and U.S. Marine Corps are subsumed in the section of the report addressing BAI operations.

If a close support relationship has been authorized by the joint force commander, the AI requests are sent directly to the supporting air-capable service component. These requests are reflected in the air allocation request as filled or requiring additional air support. If a close support relationship is not established, air support requests for AI are sent to the JFC and are addressed in the sortie allotment.

**C. Joint C3 Interface Requirements for Air Interdiction.** The joint C3 connectivity requirements for air interdiction operations are shown in figure 3-3.

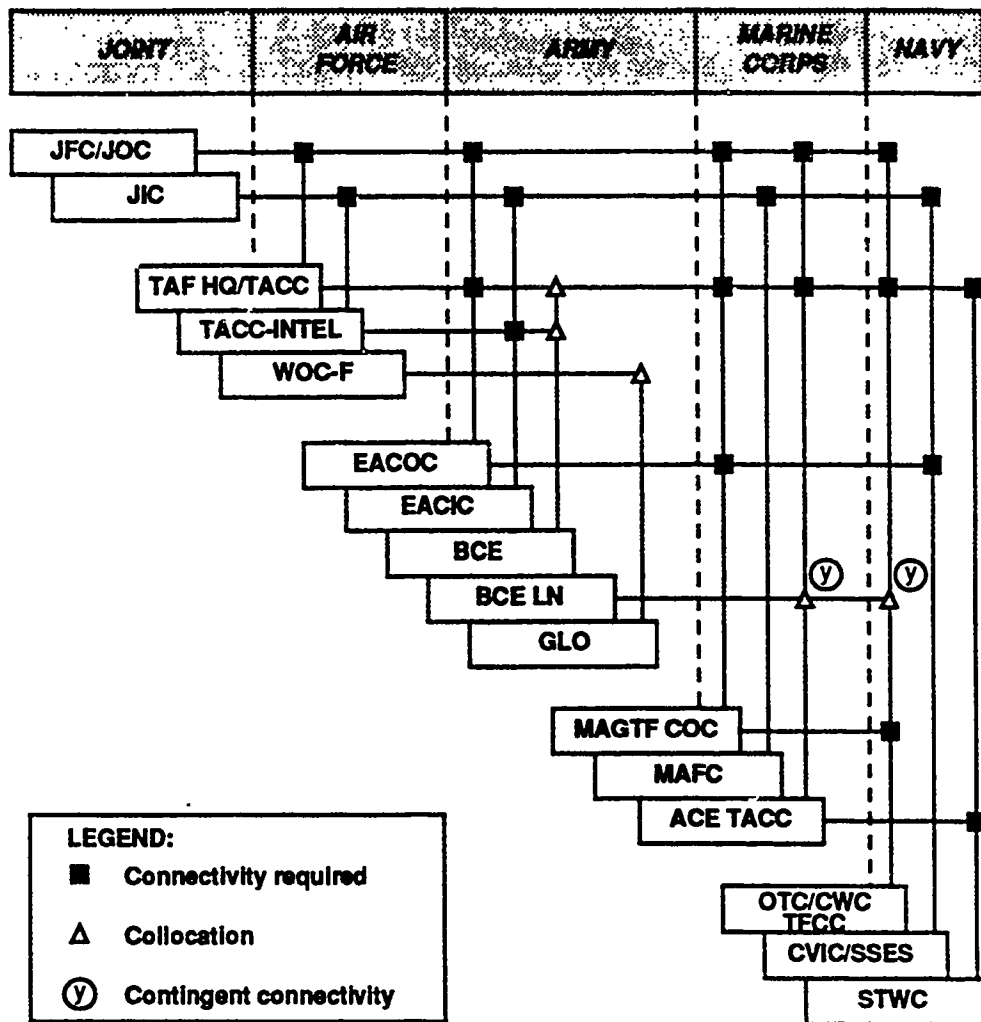


Figure 3-3. Joint C3 Connectivity Requirements for Air Interdiction

### 3-5 TACTICAL AIR RECONNAISSANCE AND SURVEILLANCE

**A. General.** The primary purpose of tactical air reconnaissance and surveillance is to satisfy the intelligence requirements of tactical commanders. Since the forces, agencies, and processes involved in tactical air reconnaissance and in tactical air surveillance operations are essentially the same, only the term "air reconnaissance" will be used in this section. Air reconnaissance employs air vehicles to obtain information concerning terrain, weather, hydrography, and the disposition, composition, movement, installations, lines of communication, and electromagnetic emissions of enemy or potential enemy forces.

The joint air operations apportionment, allocation, and sortie allocation process described previously pertains to air reconnaissance. Consequently, the following discussion identifies a limited number of additional C2 elements for joint air reconnaissance operations. For illustration, the discussion assumes that the JFC has assigned the Air Force component commander as the JFACC, and that any assigned Navy or Marine Corps fixed wing reconnaissance sorties are being managed jointly with those of the Air Force. Joint reconnaissance operations by U.S. Army and U.S. Marine Corps helicopter assets and U.S. Army fixed wing assets are requested and tasked through the JOC on a unit mission basis.

Since reconnaissance operations are responsive to intelligence collection requirements, the action agency among various C2 elements is the intelligence agency or staff element. As depicted in figure 3-4, the G2 and the intelligence support element in the component forces are involved principally in initiation and processing of air reconnaissance requests. Component level intelligence centers include U.S. Army Echelons Above Corps Intelligence Center (EACIC), MAGTF All Source Fusion Center (MAFC), U.S. Air Force Tactical Air Control Center Intelligence Divisions (TACC-INTEL), and the Navy carrier intelligence center or ship signals exploitation space (CVIC/SSES). Similarly, the J-2 and the Joint Intelligence Center (JIC) are involved at the joint force level.

**B. Tasking Joint Air Reconnaissance Operations.** The air tasking cycles described above, preplanned and immediate, apply to air reconnaissance. Figure 3-4 depicts the connectivity associated with the flow of information for those cycles. The figure depicts connectivity associated with immediate missions as a function of alternative relationships between components and different availability of on-call support.

Because processing and dissemination of reconnaissance and surveillance products are largely matters of concern to the intelligence management system, the associated connectivity is shown in truncated fashion. The first is the interface of the Air Force imagery processing center (IPC) and the U.S. Army imagery analysis (IA) section collocated with the WOC-R. The second is the down link of digital sensor data from an airborne platform (AC) to a ground support module (GSM), both of which feed intelligence information and reports to a wide range of intelligence or fire support elements. The foregoing elements are not treated as C2 elements in this architecture.

Should the U.S. Marine Corps or U.S. Navy Component Commander be designated the JFACC, the connectivity associated with the preplanned and immediate tasking cycles is unchanged in principle; however, action is centered in C2 elements associated with U.S. Army, U.S. Marine Corps and U.S. Navy. In addition to those at joint and component levels, elements included are ANGLICO teams collocated with U.S. Army elements at division, brigade, and battalion levels; the U.S. Marine Corps Aviation Combat Element (ACE)/Wing TACC with the collocated U.S. Army BCE liaison element; and the U.S. Navy OTC/CWC Tactical Flag Command Center (TFCC) with the collocated U.S. Army BCE liaison element. Connectivity with the U.S. Air Force component is principally at component level.











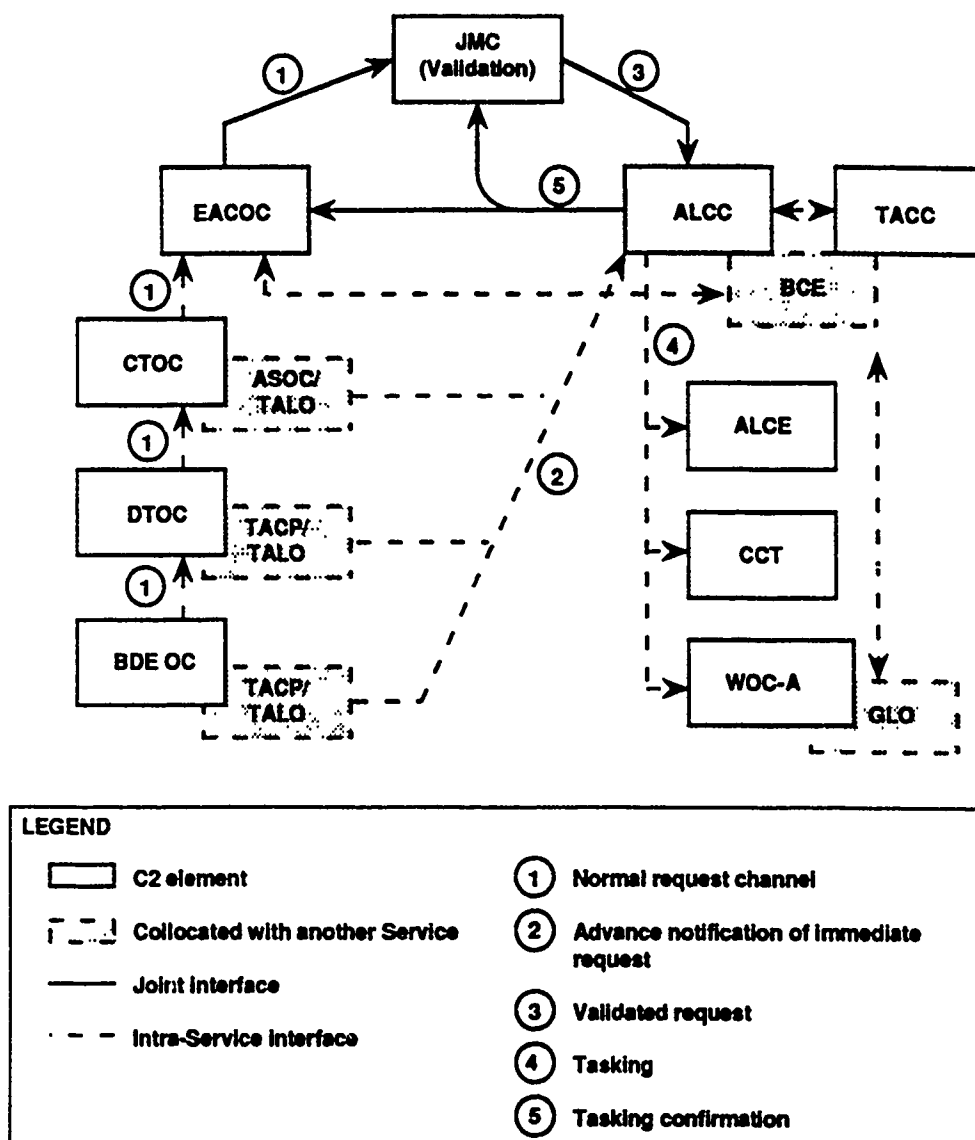


Figure 3-7. Tasking for Theater Airlift for the U.S. Army















AE support from the AECC. The AECC checks medical validation and prioritizes the request with other requests. If the request is validated on a medical basis and of appropriate priority, the AECC requests necessary airlift through the ALCC, who works with the JMC to establish it as an airlift requirement. Upon JMC validation, the ALCC tasks the airlift requirement to the WOC-A, as described for other airlift missions. The mission tasking information also is sent to the AECC, where the missions are coordinated with the AELT and originating MTF, the MASF at the forward operating location, and the destination medical facility in the rear area. The AELT coordinates the timely movement of patients from the MTF to the MASF for the AE mission.

AE support by the U.S. Army, the U.S. Navy, and the U.S. Marine Corps may become expedient or necessary. A service may have been designated or tasked to provide support to another service, or the components had agreed upon support arrangements, if direct coordination has been authorized by the JFC. This type of support is more likely to involve operations close to the casualty-producing scene, in contrast to the Air Force AE, where between-treatment facilities are reasonably removed from close combat areas.

AE support among the U.S. Army, the U.S. Navy, and the U.S. Marine Corps may engage the liaison capabilities of the ANGLICO teams provided to U.S. Army division, brigades, and battalions when those services are being employed jointly. On-the-scene connectivity between the supporting AE unit or AE flight or aircraft and the supported unit will be facilitated by the ANGLICO through necessary exchange of CEOI data and establishment of other communications arrangements. A standard medevac request format does not exist, although the information required by both services is the same.

**D. Joint C3 Interface Requirements for Aeromedical Evacuation Operations.** Figure 3-12 depicts the joint C3 connectivity requirements for aeromedical evacuation operations.

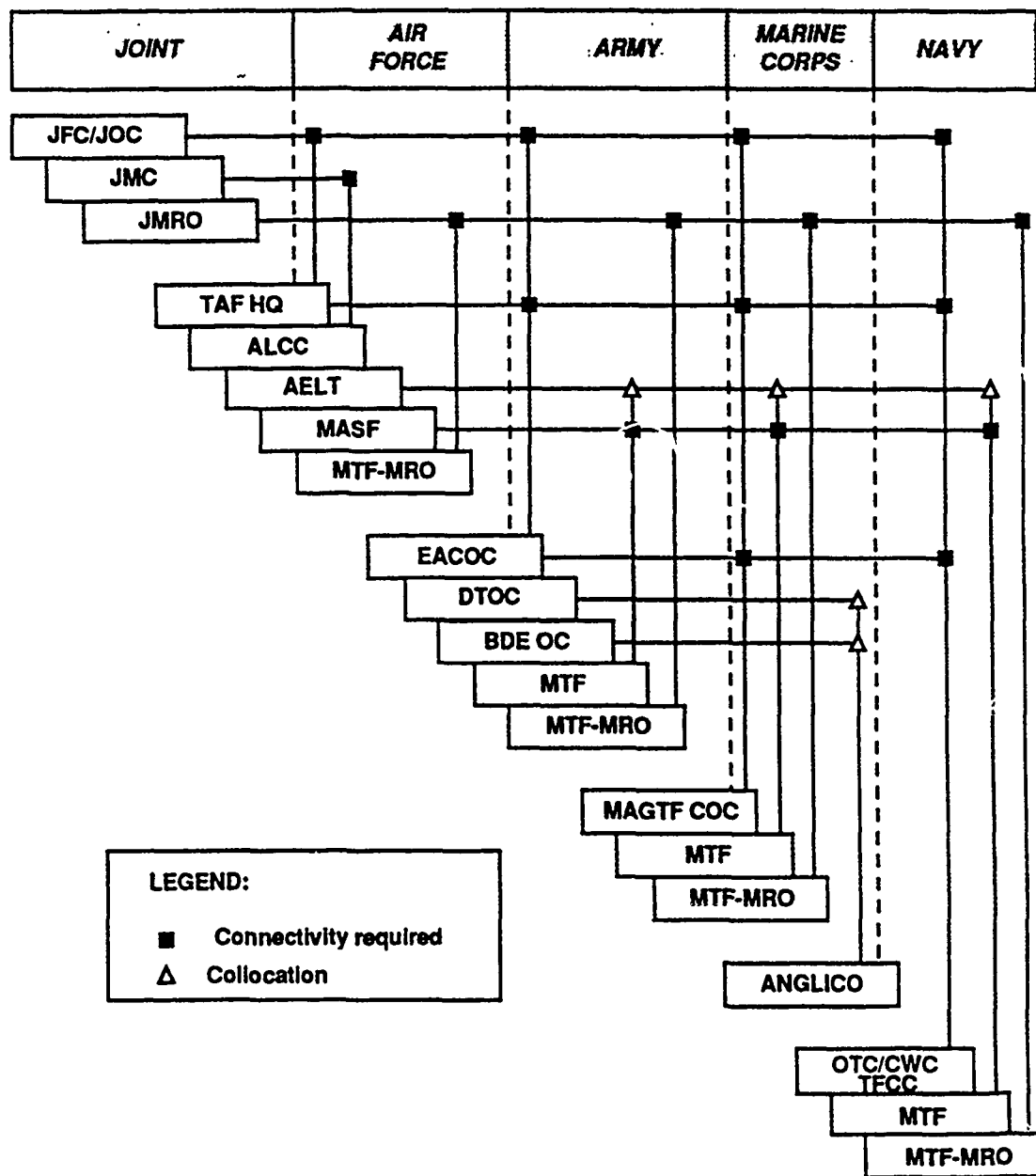


Figure 3-12. Joint C3 Connectivity Requirements for Aeromedical Evacuation















The WETM at the SOC HQ is responsible for interfacing and coordination with the joint force level WETMs and for producing various forecasts for special operations. SOWT support to the Naval Special Warfare Task Group (NSWTG) or its subordinate units, is provided by U.S. Navy forces or by other sources, if necessary, to respond to the requirements established by COMSOC.

When U.S. Army units are attached to or under the operational control of U.S. Marine Corps forces, the U.S. Army retains its attached USAF WETM at the division level, with its communication links to the corps WETM. U.S. Army units below divisional level require finished product weather support from the supported USMC unit or headquarters. When U.S. Marine Corps units are attached to or under the operational control of U.S. Army forces, the U.S. Marine Corps is responsible for providing logistic and communication support.

The WETMs and SOWTs shown in the connectivity matrix are collocated with all the elements for which connectivity is indicated. A number of the other connectivities shown among elements are implemented by the WETMs (or SOWTs) at the respective elements. U.S. Air Force, U.S. Army, and U.S. Navy special operations units are shown in the chart as part of a SOF component in the joint force. The Joint Forecast Unit (JFU) refers to the Tactical Forecast Unit previously discussed.

**C. Joint C3 Interface Requirements for Weather Operations.** Figure 3-17 depicts the joint C3 connectivity requirements for weather service operations.









differentiated from facsimile, is imagery. Requirements for this mode are unique to the intelligence functional area.

### **4-3 THE ARCHITECTURE**

The matrices, tables, and organizational relationship graphics on the remaining pages of this chapter make up the Functional C3 Interoperability Architecture for Air Operations.

Figures 4-1 and 4-2 and table 4-1 depict the joint C3 connectivity requirements for the tactical functions of offensive counterair, air interdiction, air reconnaissance and surveillance, electronic warfare, theater airlift, and aerial refueling.

Figure 4-3 and tables 4-2 and 4-3 depict the joint C3 connectivity requirements for the tactical functions of combat search and rescue, theater aeromedical evacuation, and weather service support.















Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
ARMY	MARINE CORPS		
EACOC	MAGTF COC	Command and force employment coordination	V,R,F
BCE LN	MAGTF COC	Liaison to coordinate air support in the absence of Air Force TACC; collocated with MAGTF COC (Contingent connectivity)	C
EACIC	MAFC	Exchange of intelligence information	V,R,F
TOC/CP	ANGLICO	Liaison to coordinate naval air support; collocated with Army units from company to division levels	V
ARMY	NAVY	PURPOSE OF THE INTERFACE	
EACOC	OTC/CWC TFCC	Command and force employment coordination	V,R
BCE LN	OTC/CWC TFCC	Liaison to coordinate air support in the absence of Air Force TACC; collocated with OTC/CWC TFCC (Contingent connectivity)	C
EACIC	CVIC/SSES	Exchange of intelligence information	V,R,F

\*

- 1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE  
 2 - AIR INTERDICTION  
 3 - AIR RECONNAISSANCE AND SURVEILLANCE

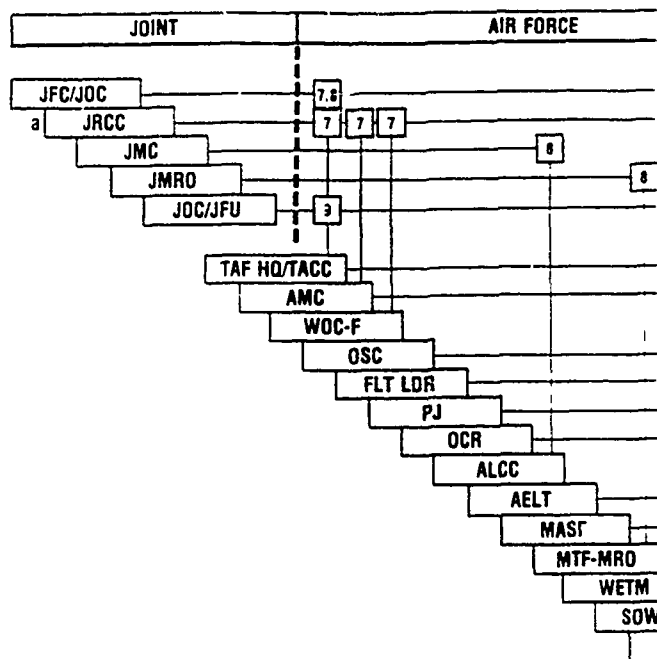
- 4 - ELECTRONIC WARFARE  
 5 - AIR LIFT  
 6 - AERIAL REFUELING

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - concluded

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
MARINE CORPS	NAVY		
MAGTF COC	OTC/CWC TFCC	Command and force employment coordination	V,R,F
MAFC	CVIC/SSS	Exchange of intelligence information	V,R,F
ACE TACC	AAWC CIC	Detailed coordination of AAW operations	V,R,D
ACE TACC	STWC CIC	Detailed coordination of air interdiction or air-to-surface OCA operations	V,R,D
ACE TACC	REFUELER	Coordination for execution of aerial refueling	V
ACE TACC	E-2	Air picture for monitoring of offensive AAW operations	V
TAOC	REFUELER	Assistance to air crews for aerial refueling	V
TAOC	FLT LDR	Assistance to air crews during OCA execution (contingent connectivity) or for aerial refueling	V
REFUELER	E-2	Coordination of participants in executing aerial refueling	V
REFUELER	FLT LDR	Coordination during aerial refueling	V
FLT LDR	E-2	Assistance to air crews during OCA execution (contingent connectivity) or for aerial refueling	V
FLT LDR	REFUELER	Coordination during aerial refueling	V

\*  
 1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE  
 2 - AIR INTERDICTION  
 3 - AIR RECONNAISSANCE AND SURVEILLANCE

4 - ELECTRONIC WARFARE  
 5 - AIR LIFT  
 6 - AERIAL REFUELING



LEGEND



JOINT CONNECTIVITY BETWEEN THE C2  
ELEMENTS INDICATED



CONNECTIVITY IMPLEMENTED BY COLLOCATION  
OF C2 ELEMENTS



A NUMBER x INDICATES THE FUNCTION  
THAT THE CONNECTIVITY PRIMARILY SUPPORTS

$$x = \begin{cases} 7 - \text{COMBAT SAR} \\ 8 - \text{THEATER AEROMEDICAL EVACUATION} \\ 9 - \text{WEATHER SUPPORT} \end{cases}$$

NOTES:

- <sup>a</sup> Air Force RCC usually serves as JRCC; the interfaces in this diagram such arrangement.
- <sup>b</sup> If the highest Army echelon is a corps, then EACOC connectivities TOC/CP represents Army echelons below corps. Specific connectivity involved. It may extend from division to company levels.
- <sup>d</sup> ANGLICO is a USMC organization manned by both the Navy and the when these Services are supporting Army operations.

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Figure 4-3.

# JOINT CONNECTIVITY FOR COMBAT SAR, AEROMEDICAL EVACUATION, AND WEATHER SUPPORT

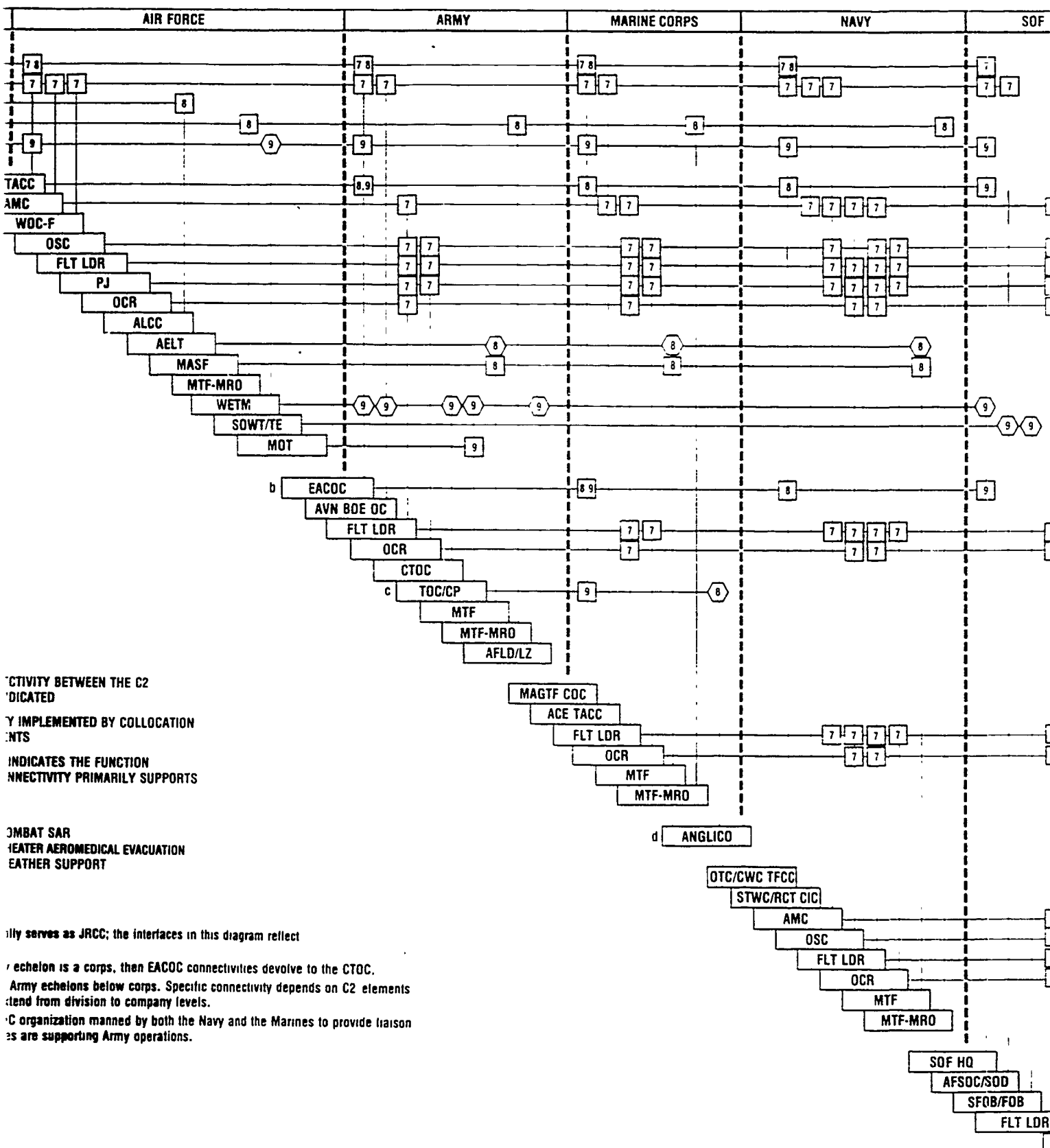
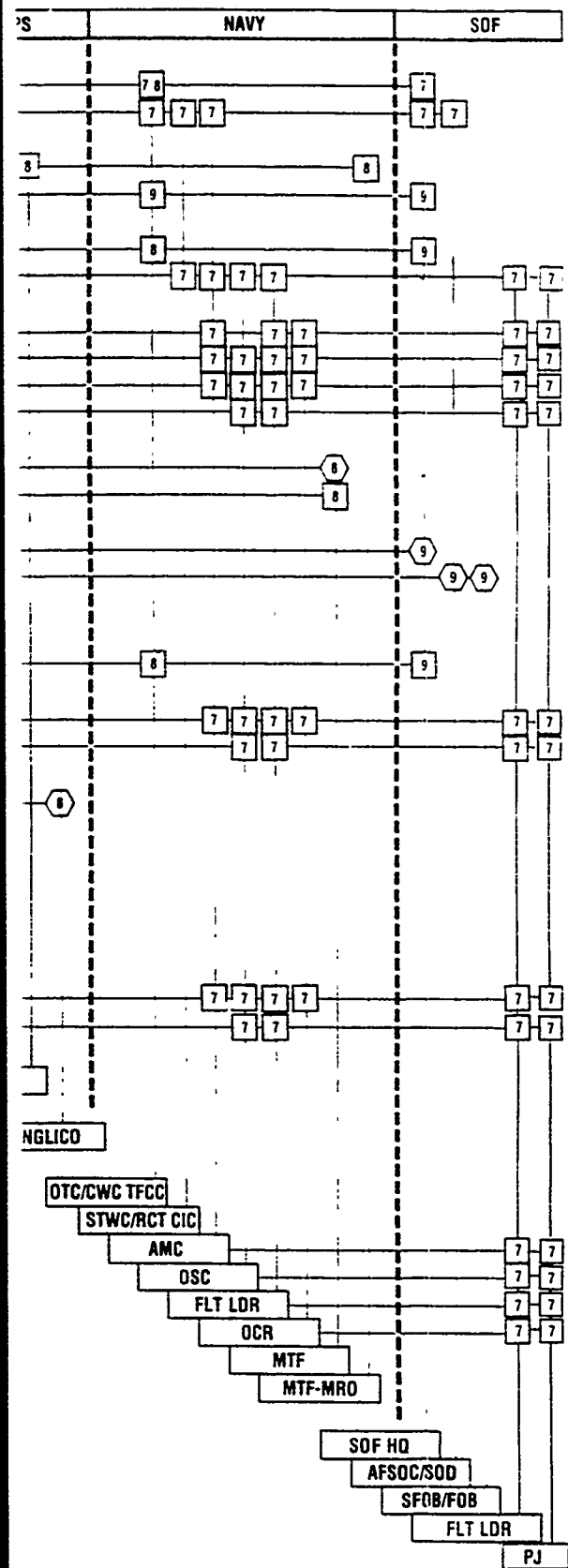


Figure 4-3. Joint Connectivity for Combat SAR, Aeromedical Evacuation, and Weather Support

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Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9)

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
JOINT	COMPONENT		
JFC/JOC	TAF HQ/TACC EACOC MAGTF COC OTC/CWC TFCC	Command coordination	V,R,D,F
JFC/JOC	SOF HQ	Command coordination for combat search and rescue	V,R
JOC/JRCC	TAF HQ/TACC	Coordination of combat search rescue operations	V,R,D
JOC/JRCC	AMC	Coordination and tasking for combat search and rescue mission	V,R
JOC/JRCC	WOC-F	Tasking for combat search and rescue mission	V,R
JOR/JRCC	EACOC	Coordination of requests for rescue search and resources; Army requests for combat search rescue support	V,R
JOC/JRCC	AVN BDE OC	Tasking for combat search rescue mission	V,R
JOC/JRCC	MAGTF COC	Coordination of requests for combat search and rescue resources; Marine requests for combat search and rescue support	V,R
JOC/JRCC	ACE TACC	Tasking of assigned combat search and rescue assets; coordination of combat search and rescue operations	V,R
JOC/JRCC	OTC/CWC TFCC	Coordination of requests for combat search and rescue resources; Navy requests for combat search and rescue support	V,R
JOC/JRCC	STWC/RCT	Coordination of combat search and rescue operations	V,R
JOC/JRCC	AMC	Coordination and tasking for combat search and rescue mission	V,R
JOC/JRCC	SOF HQ	Coordination of requests for combat search and rescue resources	V,R
JOC/JRCC	AFSOC/AFSOD	Tasking for combat search and rescue mission	V,R
JMC	ALCC	Tasking for aeromedical evacuation airlift	V,R

\*  
 FUNCTION 7 - COMBAT SEARCH AND RESCUE  
 FUNCTION 8 - AEROMEDICAL EVACUATION  
 FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
JOINT	COMPONENT		
JMRO	MTF-MRO (at each comp)	Determination of destination hospital for patients	V,R
JOC/JFU	TAF HQ/TACC EACOC MAGTF COC OTC/CWC TFCC SOF HQ	Coordination for weather support	V,R,F
JOC/JFU	WETM	Weather support team; collocated with JFU	C
AIR FORCE	ARMY	PURPOSE OF THE INTERFACE	
TAF HQ/TACC	EACOC	Coordination of aeromedical evacuation and weather support	V,R,F
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
WETM	EACOC	Weather support team; collocated with EACOC	C
WETM	AVN BDE CP	Weather support team; collocated with AVN BDE	C
WETM	CTOC	Weather support team; collocated with CTOC	C
WETM	TOC/CP	Weather support teams; collocated with Army units	C
WETM	AFLD/LZ	Weather support teams; collocated at Army airfields and landing zones	C
MOT	TOC/CP	Weather data from mobile observation teams	V,R,F
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			

★  
 FUNCTION 7 - COMBAT SEARCH AND RESCUE  
 FUNCTION 8 - AEROMEDICAL EVACUATION  
 FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
AIR FORCE	MARINE CORPS		
TAF HQ/TACC	MAGTF COC	Coordination of aeromedical evacuation support	V,R
AMC	ACE TACC	Coordination of combat search and rescue missions	V,R
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
AIR FORCE	NAVY	PURPOSE OF THE INTERFACE	
TAF HQ/TACC	OTC/CWC	Coordination of aeromedical evacuation support	V,R
AMC	STWC/RCT	Coordination of combat search and rescue operations	V,R
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
AIR FORCE	SOF	PURPOSE OF THE INTERFACE	
HQ TAF/TACC	SOF HQ	Coordination of weather support	V,R
WETM	SOF HQ	Weather support team; collocated at SOF HQ	V,R,F
SOWT/TE	AFSOC/AFSOD	Weather support teams; collocated at AFSOC/SOD	V,R,F
SOWT/TE	SFOB/FOB	Weather support teams; collocated at SFOBs/FOBs	V,R,F
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			

\*  
 FUNCTION 7 - COMBAT SEARCH AND RESCUE  
 FUNCTION 8 - AEROMEDICAL EVACUATION  
 FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - concluded

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
ARMY	MARINE CORPS		
EACOC	MAGTF COC	Coordination of aeromedical evacuation support operations	V,R
TOC/CP	MAGTF COC	Coordination of weather support for cross-attached units	V,R,F
TOC/CP	ANGLICO	Coordination of aeromedical evacuation support	C
(For connectivity associated with execution of combat search and rescue see Table 4-3)			
ARMY	NAVY	PURPOSE OF THE INTERFACE	
EACOC	OTC/CWC TFCC	Coordination of aeromedical evacuation support operations	V,R
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
ARMY	SOF	PURPOSE OF THE INTERFACE	
EACOC	SOF HQ	Coordination of weather support	V,R,F
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
MARINE CORPS	NAVY	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
MARINE CORPS	SOF	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
NAVY	SOF	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			

\*  
 FUNCTION 7 - COMBAT SEARCH AND RESCUE  
 FUNCTION 8 - AEROMEDICAL EVACUATION  
 FUNCTION 9 - WEATHER SUPPORT

Table 4-3. Joint Interfaces in the Execution of Combat Search and Rescue Missions

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
COMPONENT <sup>a</sup>			
AMC	AMC	Coordination in executing combat search and rescue mission	V
AMC	OSC		
AMC	FLT LDR		
AMC	PJ		
OSC	FLT LDR		
FLT LDR	FLTLDR		
FLT LDR	PJ		
PJ	PJ	Coordination between rescue team and object of rescue	V
OSC	OCR		
FLT LDR	OCR		
PJ	OCR		

<sup>a</sup> The C2 elements may be affiliated with Service Components as follows:

	AIR FORCE	ARMY	MARINE CORPS	NAVY	SOF
AMC	•			•	
OSC	•			•	
FLT LDR	•	•	•	•	•
PJ	•				•
OCR	•	•	•	•	

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## CHAPTER 5

### INTEROPERABILITY FINDINGS

#### 5-1 GENERAL

The joint C3 interface requirements established in the preceding chapter are based on the analyses contained in the Institute for Defense Analysis (IDA) Report 348, Supporting Analysis: Functional C3 Interoperability Architecture for Air Operations, August; 1990 (S). The interoperability findings summarized in this chapter are based on the assessments contained in the same report.

The findings relate to the capability of existing doctrine, training, operating procedures, and C2 systems and communications equipment of U.S. forces to satisfy the joint interface requirements established in this architecture. The findings identify C3 deficiencies that are, or have the potential to be, impediments to joint interoperability during air operations.

The findings in this chapter are divided into four categories: planning and tasking; joint doctrine and joint tactics, techniques, and procedures; joint information exchange; and joint training. The last section of the chapter addresses other matters having an impact on joint interoperability that require continuing attention.

#### 5-2 FINDINGS

**A. Planning and Tasking in Joint Air Operations.** Recurring themes regarding real or perceived shortcomings associated with the air tasking process represent a mixture of views: tasking takes too long to prepare; requests for some types of air missions must be made unrealistically early; tasking is too detailed; it takes too long to disseminate; it does not ameliorate differences among service practices in employing air assets.

Some aspects of the problems underlying these views are straightforward and readily amenable to technical and administrative improvements. Others reflect a more fundamental and enduring conflict between the need for an orderly process in employing air assets and the demands for responsiveness in supporting the forces on the battlefield. Finding solutions is more difficult.

The responsiveness of the formal planning, tasking preparation, and dissemination processes can be improved by use of automated planning aids and information exchange systems to provide the current status of resources and disseminate tasking and execution instructions. Networking automation systems should be considered to tie appropriate C2 nodes together to make more efficient use of the available communications capacity and increase the capability to operate in an environment degraded by C3 countermeasures.

At a minimum, the tasking processes must accommodate the following activities:

1. Complex planning process at the senior C2 levels in orchestrating various functional activities; for example, apportionment, targeting, and force packaging.
2. Preparation of aircraft for assigned missions; for example, arming and fueling by the operating air units.
3. Detailed mission planning by aircrews.

Clearly, planning lead times cannot be reduced below certain minimums dictated by aircraft and aircrew preparation times. The objective is to refine the planning and procedural process to reduce lead times while providing for aircraft and aircrew preparation.

Measures to improve combat responsiveness within the overall planning cycle have been developed, and new approaches continue to evolve. Examples include increased use of aircraft in attacks against time-sensitive targets, and new planning initiatives for creating force packages that can react on short notice to penetrate enemy airspace in attacks against interdiction targets. Taking advantage of new surveillance systems capable of producing targeting-quality data in near-real time will require even more responsive forces. Technological advances in the form of high accuracy navigation systems such as GPS and data communications systems such as JTIDS to distribute information/instructions to airborne platforms could help implement responsive employment of air forces.

**B. Joint Doctrine and Joint Tactics, Techniques, and Procedures (JTTP).** The interfaces in this architecture are based on numerous doctrinal publications. Some of the connectivity is derived explicitly; the remainder is based on the best judgments of the study team due to the rather broad guidance provided in joint doctrine. Taken in its entirety, the available body of doctrine appears to be comprehensive and well-developed for most of the operational tasks in air operations. Some of the doctrine in test form is yet to be proven in joint exercises. However, most areas for improvement appear to be more a matter of applying existing doctrine to establish JTTP than a lack of such doctrine.

Specific concerns with joint doctrine and procedures are discussed in the following paragraphs.

1. The introduction of longer range fire support weapons such as the Army Tactical Missile System (ATACMS) along with longer range target acquisition means have lead to requirements for better coordination of air, ground, and naval fires to avoid duplicative targeting, reduce fratricide, and increase efficiency in use of the weapons. The services have been moving towards cooperative fire support planning and targeting strategies. Currently, attacks against surface targets short of the Fire Support Coordination Line (FSCL) must be coordinated with the appropriate

ground force commander. Increasingly, this level of coordination for fires beyond the FSCL needs to be considered.

2. The joint tasking procedure often cannot process excess sorties from an air-capable service component sufficiently early to be included in the detailed planning for air tasking if such tasking includes participation in a force package.

3. Improving the effectiveness of joint combat rescue (CR) operations may require that doctrine be revised or clarified, and procedures be better developed. Doctrinally, no agency or service is responsible for joint CR program development, implementation, or conduct. While some services have their own CR procedures, no detailed joint CR manual exists, and the current National Search and Rescue Manual (AFM 64-2) is considered too broad and general. In an effort to correct this void, Joint Pub 3-50.2, Doctrine for Joint Combat Search and Rescue, is being developed and is planned for release as a test publication in 1991.

**C. Joint Information Exchange.** Joint information exchange requires procedures, standards, and compatible equipment to assure transfer of information over the links connecting various C2 information exchange elements. The equipment encompasses communications and data processing systems that may be located at C2 nodes and at communications facilities linking them.

In most cases, communications systems are adequate for the information flow needed to support the operational tasks included in this architecture. Maintaining connectivity and capacity during high-intensity conflict and in a moderate to severe countermeasures environment will depend on efficient and skilled use of limited assets.

Specific observations are explained in the following paragraphs.

1. Automation, or other responsive techniques are required to generate or update Joint Communications Electronics Operating Instructions (JCEOs).

2. Low-level (nap-of-the-earth or terrain-following) tactics and extended range air operations tend to exceed the limits of LOS radios. Communications needed to support the full depth of air operations depend on SATCOM, HF radios, and airborne radio relays. HF radios are being upgraded with improved frequency selection techniques and antenna systems for better transmission reliability. Airborne radio relays are used to extend the effective range of LOS radios, often with manned aircraft as a platform. A UAV is a logical candidate for this task, and developmental work to adapt LOS relays is underway. Fielding of improved HF radios and radio relay UAV systems and airborne pods must be supported to augment limited SATCOM assets for beyond LOS communications.

3. The crew of an airlift aircraft may need to communicate with numerous C2 elements along its flight path in the course of a single extended mission. The C2 elements may use several communications networks secured by

different cryptonet systems. The current method of manual operation is labor intensive and inefficient. U.S. airlift forces require the capability to transition rapidly from one COMSEC system to another.

4. Maintaining communications with Navy forces afloat can be a problem due to limited communications equipment aboard ships, use of incompatible encryption gear, and the practice of emissions control (EMCON). These factors can be particularly important in a joint task force if its JOC is afloat.

**D. Joint Training.** The previously developed C2 interface architectures on air defense/airspace control and fire support emphasized the need for joint training as a means of ensuring effective joint interactions and personnel proficiency in using C3 systems and procedures. Reports that document the lessons learned during joint exercises continually indicate the need for more joint training within the mission areas covered in the architecture.

**E. Other Matters Requiring Continued Attention**

1. Joint Surveillance Target Attack Radar System (Joint STARS). This system was developed in a joint U.S. Army and U.S. Air Force program. The system provides high resolution, large-area scrutiny of the battlefield and produces an accurate picture of the tactical situation directly to the commander and the control structure. The two major C2 elements of the system are the airborne multimode radar and the Ground Station Module (GSM). Developmental Joint STARS systems have been operated in a combat environment, and joint C3 interface requirements are evolving. Multiservice, if not joint doctrine, and JTTP that document existing interfaces and can be used to identify others, need to be developed.

2. The U.S. Army BCE positioned at an Air Force TACC lacks automation support. The Army's projected fielding of a BCE Automated Support System (BASS) in the 1989-1992 period should fill this void. The type of interface that BASS should have with the Air Force automation support at the TACC, either computer-to-computer or "swivel chair," has not been determined.

3. A concept for direct delivery of cargo by the C-17, or other advanced transport aircraft, from strategic distances to forward tactical locations is being developed. The concept calls for delivery of outsize combat equipment and cargo into austere airfields, usually operated by nonairlift units, and onto marked or unmarked drop zones in medium-threat environments. Such deliveries could be made as far forward as battalion or company areas. The direct delivery concept requires a high degree of C3 to respond to the dynamic changes in the battlefield situation.

4. Increasing use of sophisticated weapons systems whose delivery accuracies depend on weather conditions has increased the need for accurate short-term forecasts in hostile areas. A system of improved observations and forecasts is needed to provide a timely assessment of weather effects on various weapon systems in specific battle situations.

5. The pending introduction to the battlefield of potentially large numbers of unmanned aerial vehicles with joint and service component roles appears to present significant command and control challenges that should be addressed expeditiously.

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## APPENDIX A

## GLOSSARY

A2C2	Army Airspace Command and Control
AACG	Arrival Airfield Control Group
AADC	Area Air Defense Commander
AAGS	Army Air-Ground System
AAT	Army Assault Team
AATFC	Air Assault Task Force Commander
AAW	Antiair Warfare
AAWC	Antiair Warfare Commander
ABCCC	Airborne Battlefield Command and Control Center
AC	Airborne Platform/Aircraft
ACA	Airspace Control Authority
ACC	Air Component Commander
AFCC	Air Force Component Commander
ACE	Aviation Combat Element
ACP	Automatic Communications Processor
ACR	Armored Cavalry Regiment
AD	Air Defense
ADA	Air Defense Artillery
ADCOORD	Air Defense Coordinator
ADDS	Army Data Distribution System
ADF	Automatic Direction Finder
ADVON	SAC Advanced Echelon
AECC	Aeromedical Evacuation Control Center
AELT	Aeromedical Evacuation Liaison Team
AFATDS	Advanced Field Artillery Tactical Data System
AFCC	Air Force Component Commander
AFGWC	Air Force Global Weather Center
AFSOB	Air Force Special Operations Base
AFSOC	Air Force Special Operations Command
AFSOCC	Air Force Special Operations Control Center
AFSOD	Air Force Special Operations Detachment
AFSOE	Air Force Special Operations Element
AGOS	Air-Ground Operations System
AH	Attack Helicopter
AHIP	Army Helicopter Improvement Program
AI	Air Interdiction
AIR AMB	Air Ambulance
AIR CAV	Air Cavalry
AIR CAV TRP	Air Cavalry Troop
AL	Airlift
ALCC	Airlift Control Center
ALCE	Airlift Control Element

ALD	Airlift Division
ALMSNSCD	Airlift Mission Schedule (Message Format)
ALS	All-Weather Landing System
AMC	Airborne Mission Commander
AMG	Amphibious Group
ANGLICO	Air and Naval Gunfire Liaison Company
APES	Automated Patient Evacuation System
ARBS	Angle Rate Bombing System
AREC	Air Resources Element Coordinator
ARLO	Air Reconnaissance Liaison Officer
ARRS	Air Force Aerospace Rescue and Recovery Service
ARSP	Airborne Reconnaissance Support Program
AS	Aerial Surveillance
ASAS	All Source Analysis System
ASD/C3I	Assistant Secretary of Defense for C3I
ASF	Air Staging Facility
ASLT	Assault
ASMD	Anti-ship Missile Defense
ASMRO	Armed Services Medical Regulating Office
ASOC	Air Support Operations Center
ASRT	Air Support Radar Team
ASUW	Anti-Surface Warfare
ASUWC	Anti-Surface Warfare Commander
ASW	Anti-Submarine Warfare
ASWC	Anti-Submarine Warfare Commander
ATACC	Advanced Tactical Air Command Center
ATACMS	Army Tactical Missile System
ATARS	Advanced Tactical Air Reconnaissance System
ATCCS	Army Tactical Command and Control System
ATCS	Air Traffic Control System
ATDS	Airborne Tactical Data System
ATF	Amphibious Task Force
ATHS	Airborne Target Handoff System
ATO	Air Tasking Order
ATOCONF	Air Tasking/Confirmation
ATS	Air Traffic Services
AVN	Aviation
AWACS	Airborne Warning and Control System
AWADS	Adverse Weather Aerial Delivery System
AWAPS	Advanced Weather Analysis and Prediction System
AWN	Automatic Weather Network
AWS	Air Force Air Weather Service
B	Bomber (SAC)
BAI	Battlefield Air Interdiction
BCC	Battery Control Central
BCE	Battlefield Coordination Element
BCP	Battery Command Post

BDE	Brigade
BF/BG	Battle Force/Battle Group
BIC	Battery Information Center
BN	Battalion
C of S	Chief of Staff
CATCC	Carrier Air Traffic Control Center
C2	Command and Control
C2E	Command and Control Element
C2IPS	C2 Information Processing System
C3I	Command, Control, Communications, and Intelligence
C3CM	Command, Control, and Communication Countermeasures
CAP	Combat Air Patrol
CARGRU	Carrier Group
CAS	Close Air Support
CAS	Crisis Action System
CATF	Commander, Amphibious Task Force
CCE	Combat-Communications Elements
CCS	Control and Communications Subsystem
CCS2	Command, Control, and Subordinate Systems
CCT	Combat Control Team
CDS	Combat Direction System
CEWI	Combat Electronic Warfare and Intelligence
CG/CGN	Guided Missile Cruisers
CIC	Combat Information Center
CID	Combat Intelligence Division
CIFS	Close In Fire Support
CINCSAC	Commander in Chief, SAC
CJCS	Chairman, Joint Chiefs of Staff
CLF	Commander Landing Force
CMD BN	Command Aviation Battalion
CMD CO	Command Aviation Company
CNI	Communication, Navigation and Identification
COC	Combat Operations Center
COMALF	Commander of Airlift Forces
COMARRF	Commander of Aerospace Rescue and Recovery Forces
COMEDS	CONUS Meteorological Dissemination System
COMINT	Communications Intelligence
COMJTF	Commander, JTF
COMP	Component
COMSOC	Commander Special Operations Command
CP	Command Post
CR	Combat Rescue
CRC	Control and Reporting Center
CRP	Control and Reporting Post
CRTF	Combat Rescue Task Force
CS	Combat Support

CSAR	Combat Search and Rescue
CSS	Combat Service Support
CSSCS	Combat Service Support Control System
CSSE	Combat Service Support Element
CTF	Carrier Task Force
CTAPS	Contingency TACS Automated Planning System
CTOC	Corps Tactical Operations Center
CV/ASWM	Carrier Antisubmarine Warfare Module
CV/CVN	Aircraft Carriers
CVBG	Carrier Battle Group
CVIC/SSES	Navy Carrier Intelligence Center/Ship Signals Exploitation Space
CVSD	Continuous Variable Slope Delta (modulation)
CWC	Composite Warfare Commander
DA AALPS	Department of the Army Automated Air-Land Planning System
DACG	Departure Airfield Control Group
DARS	Daily Aerial Reconnaissance and Surveillance
DASC	Direct Air Support Center
DCA	Defensive Counter Air
DCT	Digital Communications Terminal
DDN	Digital Data Network
DET	Detachment
DI	Deputy for Intelligence
DIV ARTY	Division Artillery
DIV	Division
DO	Deputy for Operations
DMSP	Defense Meteorological Satellite Program
DOC	Command and Control Division
DOX	Combat Operations Division
DS/CR	Display Control/Storage and Retrieval
DSN	Digital Switched Network
DZ	Drop Zone
EAC	Echelons Above Corps
EACIC	Army Echelons Above Corps Intelligence Center
EACOC	Echelons Above Corps COC
EC	Electronic Combat
ECCM	Electronic Counter-Countermeasures
ECM	Electronic Countermeasures
EDAC	Error Detection and Correction
EHF	Extremely High Frequency
ELINT	Electronic Intelligence
EM	Electromagnetic
EMCON	Emissions Control
ENSCD	Enemy Situation Correlation Division
ENSCE	Enemy Situation Correlation Element

EOB	Electronic Order of Battle
EPLRS	Enhanced Position Location Reporting System
ESM	Electronic Support Measures
ETAC	Enlisted Tactical Attack Controller
EVAC	Evacuation
EW	Electronic Warfare
EW MOD	Electronic Warfare Module
EWC	Electronic Warfare Coordinator
EWO	Electronic Warfare Officer
EXCOM	Executive Committee
EZ	Extraction Zone
F	Fighter
FAAD C2I	Forward Area Air Defense Command, Control and Intelligence
FAC	Forward Air Controller
FAC(A)	Forward Air Controller (Airborne)
FACP	Forward Air Control Post
FASCO	Forward Area Support Coordinating Officer
FDDS	Flag Data Display System
FLIR	Forward Looking Infra-Red
FLOT	Forward Line of Own Troops
FLT LDR	Flight Leader
FLTCINC	Fleet Commander in Chief
FMF	Fleet Marine Forces
FMF-EUCE	Fleet Marine Force-End User Computing Equipment
FOB	Forward Operating Base
FOFA	Follow-On Force Attack
FOL	Forward Operating Location
FLTPORTREP	Fleet Port Representative
FRAG	Air Operations Fragmentary Order
FSCl	Fire Support Coordination Line
FSCoord	Fire Support Coordinator
FSE	Fire Support Element
FTAO	Force Tactical Action Officer
FTI	Fixed Target Indicator
FW	Fixed Wing (Aircraft)
GCE	Ground Combat Element
GCI	Ground Control Intercept
GCS	Ground Control Station
GDSS	Global Decision Support System
GLO	Ground Liaison Officer
GPS	Global Positioning System
GS	Ground Station
GSM	Ground Station Module

HC(A)	Helicopter Coordinator (Airborne)
HEC	Helicopter Element Coordinator
HDC	Helicopter Direction Center
HF	High Frequency
HML/A	Marine Light/Attack Helicopter
HMM	Marine Medium Assault Helicopter
HQ	HAVE QUICK
HST	Helicopter Support Team
IA	Army Imagery Analysis
IC	Intelligence Center
ICC	Information Coordination Central
IEW	Intelligence/Electronic Warfare
IFF	Identification Friend or Foe
IHFR	Improved High Frequency Radio
INS	Inertial Navigation System
IPC	Air Force Imagery Processing Center
ISOPREP	Isolated Personnel Report
J-CSAR	Joint Combat Search and Rescue
JAAT	Joint Air Attack Team
JACC/CP	Joint Airborne Communication Center/Command Post
JCEWS	Joint Force Commander's Electronic Warfare Staff
JCSE	Joint Communications Support Element
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JFU	Joint Forecast Unit
JIC	Joint Intelligence Center
JMC	Joint Movement Center
JMRO	Joint Medical Regulating Office
JMSWG	JTIDS Message Standards Working Group
Joint STARS	Joint Surveillance Target Attack Radar System
JOP	Joint Operations Procedure
JPO	Joint Program Office
JR	Jam Resistance
JRCC	Joint Rescue Coordination Center
JSIPS	Joint Service Imagery Processing System
JSOTF	Joint Special Operations Task Force
JTACMS	Joint Tactical Missile System
JTAO	Joint Tactical Air Operations
JTC	Joint Technology Center
JTCB	Joint Targeting Coordination Board
JTF	Joint Task Force
JTIDS	Joint Tactical Information Distribution System
JTL	Joint Target List
JTTP	Joint Tactical Techniques and Procedures
JUSMAG	Joint U.S. Military Advisory Group

LAAD	Light Antiair Defense
LAAM BN	Light Antiair Missile Battalion
LAN	Local Area Network
LANA	Low-Altitude Night Attack
LAPES	Low Altitude Parachute Extraction System
LCC	Land Component Commander
LCC	Amphibious Flagship (Ship Type)
LENSCE	Limited Enemy Situation Correlation Element
LHX	Light Attack Helicopter
LO	Liaison Officer
LOCE	Linked Operational/Intelligence Centers
LOH	Light Observation Helicopter
LOI	Letter of Instruction
LOS	Tactical Line of Sight
LOT/SC	Laser Detector Tracker/Strike Camera
LZ	Landing Zone
LZCT	LZ Control Team
MAC	Military Airlift Command
MACCS	Marine Air Command and Control System
MAFC	MAGTF All-Source Fusion Center
MAG	Marine Aircraft Group
MAGTF	Marine Air Ground Task Force
MARC	MAC ALCE Reaction Communications System
MARRES	Manual Radar Reconnaissance Exploitation System
MASF	Mobile Aeromedical Staging Facility
MATCALS	Marine Air Traffic Control and Landing System
MATCS	Marine Air Traffic Control Squadron
MCC	Movement Control Center
MCO	Movement Control Officer
MCS	Maneuver Control System
MCT	Movement Control Team
MDM BN	Medium Lift Battalion
MEB	Marine Expeditionary Brigade
MED BDE	Medical Brigade
MED	Medical
MEDEVAC	Medical Evacuation
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MI BDE	Military Intelligence Brigade
MI	Military Intelligence
MMC	Materiel Management Center
MOT	Mobile Observing Team
MPA	Maritime Patrol Air
MPS	Mission Planning System
MRCC	Navy Medical Regulating Center
MRO	Medical Regulating Officer
MSE	Mobile Subscriber Equipment

MTE	Medical Treatment Element
MTF	Joint Message Text Format
MTF	Medical Treatment Facilities
MTI	Moving Target Indicator
NAF	Numbered Air Force
NAO	Naval Aviation Observer
NCCS	Navy Command and Control System
NFO	Naval Flight Officer
NOE	Nap-of-the-Earth
NSWTG	Naval Special Warfare Task Group
NSWTU	Naval Special Warfare Task Unit
NTDS	Naval Tactical Data System
O&C	Operations and Control
OAAW	Offensive Antiair Warfare
OC	Operations Center
OCA	Offensive Counter Air
OCR	Object of Combat Rescue
OICWSF	Officer-in-Charge, Weather Support Force
OPCON	Operational Control
OPGEN	General Operation
OPLAN	Operation Plan
OPORD	Operation Order
OPV	Optionally Piloted Vehicle
OSC	On Scene Commander
OTC	Officer in Tactical Command
OTH	Over-the-Horizon
PCS	Portable Control Station
PJ	Pararescue Element
PLI	Position Location Information
PORTREP	Port Representative
PRESSURS	Pre-Strike Surveillance/Reconn System
PRT	Pararescue Team
QRCP	Quick Reaction Communications Package
QRCT	Quick Reaction Communications Terminal
RCC	Rescue Coordination Center
RCT	Rescue Coordination Team
RECCE	Reconnaissance
REC	Radio Electronic Capability
REQCONF	Request Confirmation
RESCAP	Rescue Combat Air Patrol
RESCORT	Rescue Escort
ROE	Rules of Engagement
RPV	Remotely Piloted Vehicle

RRS	Remote Receiving Station
RTF	Return to Force
RW	Rotary Wing (Aircraft)
S/EWCC	Signals Intelligence Electronic Warfare Coordination Center
SALT	Battalion Supporting Arms Liaison Team
SAR	Search and Rescue
SARDO	Search and Rescue Duty Officer
SARSAT	Search and Rescue Satellite Aided Tracking
SC	Screen Commander
SCDL	Army Surveillance and Control Data Link
SCOTT	Single Channel Objective Tactical Terminal
SEAD	Suppression of Enemy Air Defenses
SEAL	Sea-Air-Land
SEMA	Special Electronic Mission Aircraft
SERER	Survival, Evasion, Resistance, Escape and Recovery
SFOB	Special Forces Operations Base
SFOD	Special Forces Operations Detachment
SGN	Surgeon
SINCGARS	Single Channel Ground and Airborne Radio System
SKE	Station Keeping Equipment
SO	Special Operations
SOC	Special Operations Capable
SOF	Special Operations Forces
SOW	Special Operations Wing
SOWT	Special Operations Weather Team
SRIG	Surveillance, Reconnaissance and Intelligence Group
SSB	Single Sideband
SSES	Ships Signal Exploitation Space
STRATFOR	Strategic Forces Liaison Element
STW	Strike Warfare
STWC	Strike Warfare Commander
SURG	Surgeon
SWO	Staff Weather Officer
TA CO	Target Acquisition and Reconnaissance Company
TA PLAT	TA Platoon
TABWS	Tactical Air Base Weather Station
TAC CP	Tactical Command Post
TAC(A)	Tactical Air Coordinator (Airborne)
TACAIR	Tactical Air
TACC	Tactical Air Control Center (Air Force)
TACC	Tactical Air Command Center (Marine)
TACC-INTEL	Air Force Tactical Air Control Center Intelligence Divisions
TACFIRE	Tactical Fire Direction System
TACP	Tactical Air Control Party
TACS	Tactical Air Control System

TACSATCOM	Tactical Satellite Communications
TADC	Tactical Air Direction Center
TADIL	Tactical Data Information Link
TAES	Tactical (Intratheater) Aeromedical Evacuation System
TALO	Tactical Airlift Liaison Officer
TAMCA	Theater Army Movement Control Agency
TAMS	Theater Airlift Management System
TAOC	Tactical Air Operations Center
TAOM	Tactical Air Operations Module
TDA	Tactical Decision Aid
TDS	Tactical Data Station
TE	Tactical Element
TEP	Tactical ELINT Processor
TERPES	Tactical Electronic Reconnaissance Processing System
TESS	Tactical Environmental Support System
TF	Task Force
TFCC	Tactical Flag Command Center
TFU	Tactical Forecast Unit
THTR AVN BN	Theater Army Aviation Battalion
TIDS	Tactical Imagery Display Satellite
TKR	Tanker
TOC	Tactical Operation Center
TOT	Time-on-Target
TREDS	Tactical Reconnaissance Exploitation Demonstration System
TRI-TAC	Tri-Services Tactical Communications
TRIGS	TR-1 Ground Station
TRT	TEREC Remote Terminal
TSE	Army TOC Support Element
TSE	TOC Support Element
TTY	Teletypewriter
TU	Tracking Unit
TUOC	Tactical Unit Operations Center
TWAC	Tactical Weather Analysis Center
UARS	Unmanned Air Reconnaissance System
UAV	Unmanned Aerial Vehicle
UNAAF	Unified Action Armed Forces (Joint Pub 0-2)
URG	Underway Replenishment Group
USTS	UHF Satellite Terminal System
VAK	Carrier-Based Tanker Aircraft
VAL	Navy Light Attack Forces
VERTREP	Navy Vertical Replenishment
VFA	Strike Fighters
VMAQ	Marine Corps EW/ Reconnaissance Squadron
VMFA	Marine Fighter/Attack (squadron)
VMGR	Marine Land-Based Tanker Aircraft

VOD	Vertical On-Board Delivery
VSTOL	Vertical/Short Takeoff and Landing
WETM	Weather Team
WOC	Wing Operations Center
WOC-A	WOC Airlift
WOC-F	WOC Fighter
WOC-R	WOC Reconnaissance
WSF	Weather Support Force

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